Review Article

Sleep quality and sleep disorders post COVID-19 infection: Review article

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ABSTRACT

Background: All elements of everyday life have been seriously and significantly impacted by the global COVID-19 outbreak. Previous research has demonstrated a connection between infectious disease epidemics and sleep disturbances as well as psychological discomfort, such as traumatic stress, melancholy, and anxiety.

Objectives: The study aimed to summarize current evidences about sleep quality and sleep disorders for patients that had Covid-19 infection.

Methods: For article selection, the PubMed database and EBSCO Information Services were used. All articles relevant with our topic and other articles were used in our review. Other articles that were not related to this field were excluded. The data was extracted in a specific format that was reviewed by the group members.

Conclusion: Our study included 8 studies in total. Patients with recovered COVID-19 showed a statistically significant prevalence of insomnia than control groups. Patients must be advised to follow-up if they have trouble sleeping as a result. Early detection and treatment of people who are experiencing insomnia are crucial to prevent long-term harmful effects as increase in the intensity of depression, anxiety, and post-traumatic stress that were shown to be substantially correlated with poor sleep quality.

Keyword: Epidemics, Discomfort, Sleep disorders, COVID-19 infection.

Introduction

The global COVID-19 outbreak, which was brought on through the SARS-CoV-2 coronavirus and was first discovered in Wuhan, China, in the month of December 2019, has experienced a severe and profound influence on all facets of daily life. It is hardly surprising that as a result, sleep habits, sleep standards, as well as the detection and treatment all of the sleep problems significantly as well as quite unexpectedly influenced. The fear and anxiety of possibility infections, required lockdowns, as well as Quarantine actions have all contributed up to a point of sleep disruption whose full impact has not yet been fully described, both among the general public and medical professionals (HCWs). Additionally, studies examining research on patients with COVID-19 who have sleep problems is ongoing [1-3]. Previous research has demonstrated a connection between infectious disease epidemics and sleep disturbances as well as psychological discomfort, such as traumatic stress, melancholy, and anxiety. Physical disease, past

Access this article online	
Quick Response Code:	Website: www.smh-j.com
	DOI: 10.54293/smhj.v2i3.50

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Received: 1 October 2022 | **Accepted:** 25 October 2022

Please cite this article as: Mohammad Alsudairy N, Shamikh Alharbi T, Abdullah Mohammed Alghamdi M, Hussain M Hakami H, Ibrahim Alomran H, Bishan A khalban A, Mohammed A Dajam A, Abdullah T Alali J, abdulrazzaq alshareif L, Abdullah Albesher M, Saleh Al Ismail S, Hamed Alkhaibari S. The Sleep quality and sleep disorders post COVID-19 infection: Review article. SMHJ [Internet]. 2022;2(3):103-112. Available from: https://www.smh-j.com/smhj/article/view/50

SMHJ
Saudi Medical Horizons Journal

Mental health issues, environmental pressures, social isolation, being cut off from family and friends, and other outbreak-controlling tactics are all contributing causes. The new coronavirus illness appears to have a major influence on public mental health, similar to earlier infectious diseases. This is supported by the available data generating anxiety, mental health issues, and sleep disturbances in a variety of populations, including members of the general public, healthcare providers (HCPs), and SARS-CoV-2 patients. Sleep problems and other neuro-psychiatric symptoms are more common in COVID-19 individuals, according to a number of studies. For instance, up to 96% of stable inpatient patients had signs of post-traumatic stress disorder, and freshly recovered patients had higher levels of depression (29%) compared to those in quarantine (9.8%) [4-10]. It has been demonstrated that the desire for loneliness that results from battling this illness reduces how well healthy individuals sleep. Healthcare professionals, who are leading the fight against this epidemic, also have a tremendous amount of work to do as a result of international health initiatives. Because of the continuous crisis, it is obvious that healthcare professionals are being physically and psychologically impacted by the epidemic. The primary complaints of COVID-19 patients who were improving were weariness, muscular weakness, and sleep issues six months following the beginning of symptoms. One of the most prevalent symptoms, at a rate of 26%, was sleep problems [11-15]. The COVID-19-related sleep disruption is likely caused by a number of factors. A recent meta-analysis revealed so as to during the COVID-19 pandemic, the general population worldwide experienced relatively high rates of anxiety symptoms (ranging from 6.33% to 50.9%), depression symptoms (14.6%–48.3%), post-traumatic stress disorder (PTSD) symptoms (7%–53.8%), psychological distress (34.43%–38%), and stress symptoms (8.1%–81.9%). Among the risk factors identified include being a woman, being younger (less than 40 years old), having mental or chronic illnesses, being unemployed, having a high level of education, and frequently using social media and reading news about COVID-19. The correlation between insomnia, anxiety, and depression is well established, and studies have revealed that during the epidemic, the pervasiveness of this psychological distress has grown in the general population [1, 16].

Study Objective: The study aimed to summarize current about sleep quality and sleep disorders for patients that had Covid-19 infection

Methods

Study aim: In the direction of defining a coherent plan for empirical study that incorporates existing knowledge, it is thought that a thorough examination of the available data on the relationship between poor sleep quality and sleep disorders for patients who had Covid-19 infection is a reliable method of locating when synthesising the relevant peer-review literature. Only qualitative information were used in this review to support an interpretation. Additionally, an analysis of qualitative information attempts to produce conclusions that have significance, pertinent, and appropriate for each individual, to guide a research agenda, with the intention of improving treatments for patients with Covid-19 infection who have sleep difficulties. The review aggregated, integrated, and evaluated the data from the included studies using qualitative synthesis techniques, if possible. The review aimed to provide additional interpretive insights beyond the mere data aggregation. A better understanding of the connection between sleep issues and patients with Covid-19 infection.

Criteria for study eligibility: Peer-reviewed qualitative research were included in the review. Mixed method studies' qualitative data was assessed for purposes of both only consisting of the relevant qualitative component. We discussed the researches that were completed within the past 12 months. Included researches were all peer-reviewed English-language studies reporting a connection between individuals with Covid-19 infection and sleep problems. Studies must have been published between September 2021 and October 2022 in order to be included for the evaluation and ensure the work's currency while permitting the identification of emerging challenges from a variety of perspectives. Studies involving patients rather than the broader public or healthcare professionals should be included in the article.

Study Inclusion and Exclusion criteria: The articles were chosen with the project's relevancy, English proficiency, and a 20-year time limit in mind. All additional publications, repeated studies, reviews of research, and articles that did not have one of these issues as their primary end were disregarded. No English-language studies, conference summaries, publications, grey literature, and editorial observations were disregarded by the reviewers. Studies that simply provided qualitative data were not included.

Search strategy: To locate peer-reviewed literature on sleep quality and sleep disorders post COVID-19 infection in Saudi Arabia, a systematic search method was created utilising a combination the headings for

medical subjects (MeSH) and restricted language. The databases included Google Scholar, EbscoHost, PubMed/MEDLINE, and Scopus/Embase (Elsevier). Selection of study: The selection procedures and outcomes were presented in accordance with the ENTREQ reporting criteria for qualitative systematic reviews. To help with duplication removal, all the extracted studies first be brought into the Endnote repository. After eliminating the imitations, the two reviewers used a shared Endnote library to individually browse the papers by the heading and summary while being led via the qualifying requirements. The research that both reviewers would have selected were given a full-text review. Any disagreements between the two reviewers were resolved by a third examiner. The whole of all passages qualifying research were examined by the two reviewers independently. Consensus was sought in cases where there were disagreements between the two reviewers by talking about the disagreements with the third reviewer. For the final framework synthesis, the complete texts of all pertinent research that satisfied the inclusion criteria were kept.

Extraction of data: Two reviewers separately extracted data from qualifying studies onto a special data extraction form, filling it with information about the research population and the relevant phenomena. The third review author double-checked and verified the extracted articles. The initial author's name, the publication year, the duration of the data collection, and the area where the study was done are among the study features that were extracted. Then, specific study information such as the study's design, demographic, size of the sample, sampling techniques, the data gathering techniques were documented. Sleep problems and sleep quality were related in people with Covid-19 infection.

Data synthesis and analysis: Data analysis was done without the use of any software. The reviewers arranged the information according to themes and displayed the topics in a table of analysis (chart). We compared study results across many themes and subthemes thanks to the table's columns and rows reflecting studies and associated topics.

Interpreting as well as mapping: Charts resolve were used by the reviewers to chart the extent and make-up of the phenomenon and define the ideas that have been identified. For the purpose of elucidating the conclusions, our review examined relationships between the concepts. According to the review's objectives and emergent themes, the findings were mapped out and interpreted.

Results

The selection and identification of research are shown in Figure (1). All of 314 databases were searched, studied and located, then used for title screening. 213 remained after removal of duplication and 67 of them were excluded for abstract screening. The full texts of the remaining 146 publications were examined. Due to different study objectives, the full-text revision resulted in elimination of 138 studies, and 8 were enlisted for final data extraction (Figure 1) and (Table 1). Choudhry et al. [17] patients with recovered COVID-19 have a statistically significant prevalence of sleeplessness after 30 days of follow-up. Additionally, 215 recovered patients (84%) in Al-Ameri et al. [18] research's control group outnumbered 384 patients (78%) had sleep problems. The Pittsburgh Sleep Quality Index (PSQI) principles for the recovered as well as control group were 8.77 and 8.1, respectively, by a significant p-value of 0.014. Standard sleep times were 6.899 and 6.44 for recovered and control patients respectively (by a substantial p-value of 0.01). The recovery patients' sleep latency was 29 minutes, whereas the control patients' sleep latency was 33 minutes, which was not statistically significant (p=0.374). Because of this, COVID-19 survivors had more trouble sleeping than the control group did (Table 1). The Short Form 36 scale was used to evaluate overall quality of life in El Sayed et al. [19] study. The Pittsburgh Sleep Quality Index (15.37), the Insomnia Severity Index (13.01), and a number of other items of the Quality-of-Life Scales were found to have high scores for the examined group. There are 122 COVID-19 patients and 588 control people in Mekhael et al. [20] study. Overall sleep time had a positive connection with oxygen saturation and respiratory rate (RR) (SpO_2). Greater awake sleep phase was accompanied by increases in heart rate, RR, heart rate variability (HRV), and SpO_2. In COVID-19 group, longer periods of light sleep were linked to increased RR and SpO_2. Prolonged deep sleep was linked to lower heart rate, higher RR, and greater SpO_2. In comparison with individuals without the disorder (123 vs. 128), patients with a lengthy COVID-19 spent less time in light sleep (244 versus 258) and less time in deep sleep (Table 1). According to Nowakowski et al. [21] research, 50.6% of people said that their sleep became worse after contracting COVID-19. With 65 people reporting poor sleep quality, PSQI score was 9.7 (82.3%). The average GAD-7 score was 8.3 (n = 14, 22.8%, very depressed). The average PHQ-9 score was 10.1 (17.8%, n = 18 severe anxious subjects). The median

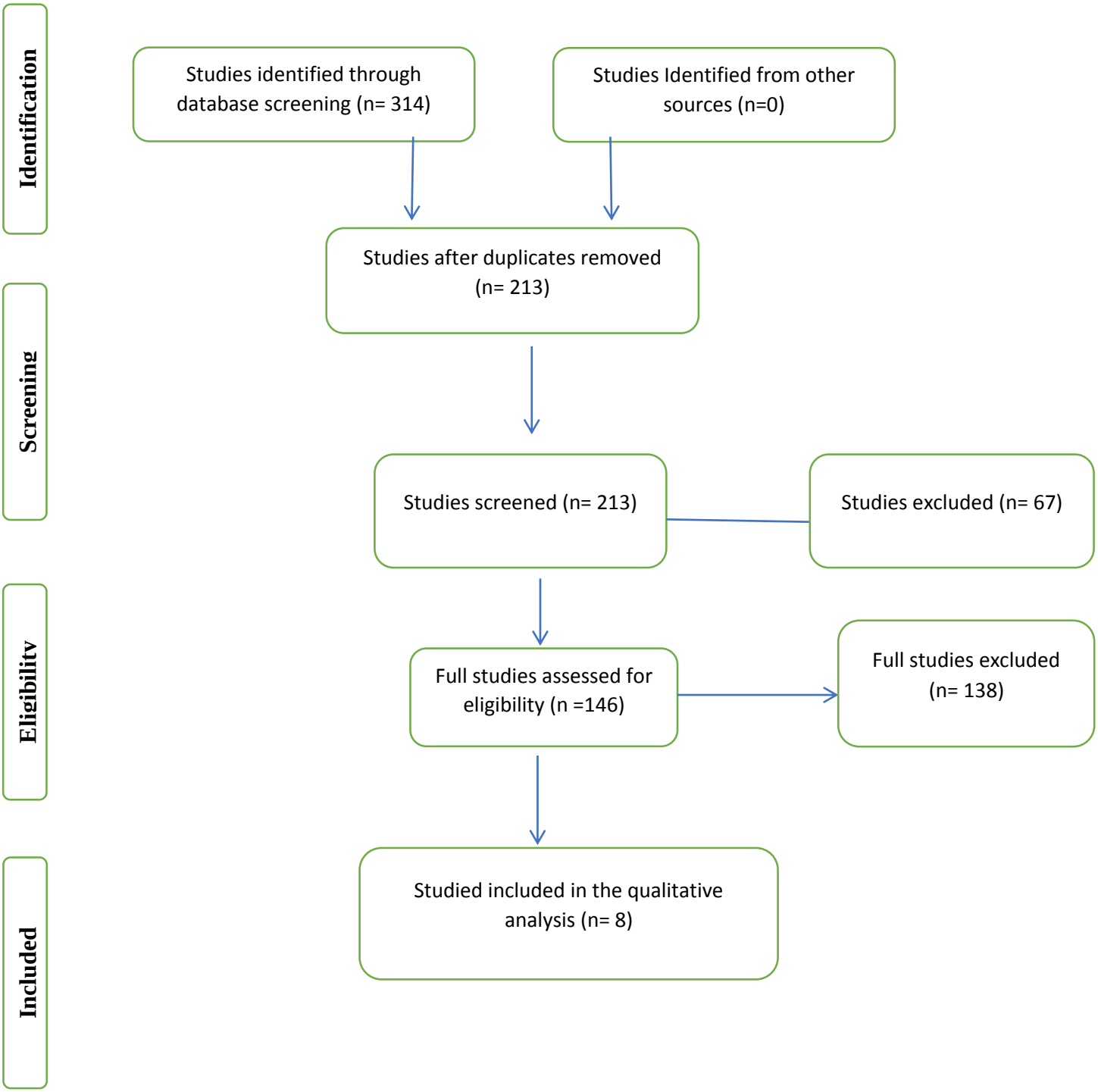

Figure 1: Extraction of the included studies.

Table 1: Author, country, year of publication, methodology and outcome.

Author, Publishing Year	Methodology	Outcomes
Choudhry et al. 2021 [17]	Longitudinal research was carried out between January and March of 2021. At the time of their discharge, 500 patients who had been hospitalised to COVID-19's isolation or critical care units were included in the research. The Pittsburgh Sleep Quality Index was used to assess the subjects' pre-COVID-19 sleep quality (PSQI). A 30-day follow-up was used to measure the quality of post-COVID sleep.	When compared to the pre-COVID-19 group, the mean PSQI score was considerably higher in the post-COVID-19 group (6.28 vs. 3.22; p-value 0.0001). When compared to the pre-COVID-19 group, the proportion of individuals with a PSQI score of less than five was considerably greater in the post-COVID-19 group (45.1% vs. 12.1%; p-value 0.0001). After 30 days of follow-up, patients with recovered COVID-19 showed a statistically significant prevalence of insomnia. Patients Must be advised to follow up if they have troubles in sleeping as a result. Early detection and treatment of people who are experiencing insomnia are crucial to prevent long-term harmful effects.
Al-Ameri et al. 2022. [18]	256 individuals who had recovered from coronavirus sickness in 2019 participated in a case-control research, with 491 people serving as the control group. The Pittsburgh sleep quality index was used to gauge individuals' levels of sleep quality. Additionally, the number of hours required for sleep and sleep latency were computed. The variables were examined using the statistical methods of chi-square and t-test.	384 patients (78%) in the control group and 215 recovered patients (84%) had issues with their sleep. With a significant p-value of 0.014, the PSQI values for the recovered and control groups were 8.77 and 8.1 respectively. With a significant p-value of 0.01 and average sleep durations of 6.899 and 6.44 for recovered and control patients respectively. The recovery patients' sleep latency was 29 minutes, whereas the control patients' sleep latency was 33 minutes, which was not statistically significant (p=0.374). Patients who had recovered from COVID-19 had greater sleep difficulties than the control group did.
El Sayed et al. 2021 [19]	A cross-sectional observational study used the Insomnia Severity Index and Pittsburgh Sleep Quality Index (PSQI) to look at 500 patients' sleep issues in the post-recovery period. It also looked at how these issues related to this crucial time and how they affected various aspects of Quality of Life as measured by the SF36 Health Survey.	The Short Form 36 scale was used to assess overall quality of life. The study found that the tested group had high scores on the Pittsburgh Sleep Quality Index (15.37), the Insomnia Severity Index (13.01), and several other items of the Quality-of-Life Scale. In the recovery time following COVID-19, sleep abnormalities were often observed. These sleep deficits also had an effect on the physical and emotional facets of quality of life, therefore these sleep issues must be addressed carefully, especially during this crucial epidemic period.
Mekhael et al. 2022. [20]	Patients who had previously experienced COVID-19 were contrasted with a control group of those who had never experienced COVID-19. For each patient, baseline demographic data were gathered. The linear correlations between the average length of each sleep phase and the average daily biometrics were performed. Each subject's average nightly total sleep time and number of sleep phases were determined and compared between the two groups.	There were 122 COVID-19 patients and 588 control subjects. The relationship between total sleep time and oxygen saturation and respiratory rate (RR) was favorable (SpO_2). Heart rate, RR, heart rate variability (HRV), and SpO2 all rose with greater awake sleep phase. In the COVID-19 group, more light sleep duration was associated with higher RR and SpO_2. Reduced heart rate, elevated RR, and higher SpO_2 were all associated with prolonged deep sleep. Patients with a long COVID-19 had less time in light sleep (244 versus 258) and less time in deep sleep, as compared to those without the condition (123 vs. 128). Patients with a history of COVID-19 infection showed altered sleep architecture as compared to matched controls, regardless of demographics or the severity of their symptoms. Patients with COVID-19 had less deep sleep overall, which was a hallmark of their sleep patterns.

Author, Publishing Year	Methodology	Outcomes
Nowakowski et al. 2022. [21]	A study included patients attending to one post-acute COVID-19 recovery clinic to investigate new diagnoses of insomnia and referrals to pulmonary and sleep medicine clinics for treatment of sleep disturbances. Researchers wanted to investigate the connection between inadequate sleep, depression, anxiety, and post-traumatic stress.	Patients visited the clinic on average 2 months after contracting COVID-19; 51.9% of them had been hospitalised, 11.4% were in the critical care unit, 2.5% (n = 2) using mechanical ventilator, and 38.0% were released on oxygen. The most often reported symptom was weariness (88%), and 50.6% of people said that their sleep had been worse after contracting COVID-19. With 65 people reporting poor sleep quality, the mean PSQI score was 9.7 (82.3%). The average GAD-7 score was 8.3 (n = 14, 22.8%, very depressed). The average PHQ-9 score was 10.1 (17.8%, n = 18 severe anxious subjects). The median IES-6 score for the n = 43 post-traumatic stress cases was 2.1 (54.4%). An increase in the intensity of depression, anxiety, and post-traumatic stress was shown to be substantially correlated with poor sleep quality.
Ahmed et al. 2021. [22]	Researchers sought to identify any connections between the severity of COVID-19 at the time of start and sleep and mental illness, as well as the long-term effects of post-COVID-19 disease on sleep and mental health. According to WHO recommendations, investigators enrolled 182 patients 6 months after COVID-19 infection and divided them into non-severe (101), severe (60), and critical (20) groups. The Pittsburgh Sleep Quality Index, the PTSD Checklist for DSM-5, and the Symptom Checklist 90 exam were used to evaluate each participant.	Only 8.8% of people reported having no psychiatric symptoms, compared to 91.2% who reported the following symptoms: insomnia (64.8%), PTSD (28.6%), somatization (41.8%), obsessive-compulsive disorder (OCD) (19.8%), depression (11.5%), anxiety (28%), phobic anxiety (24.2%), and psychoticism (17.6%). Sleep impairment was at risk with diabetes, oxygen supplementation, or mechanical ventilation, but PTSD was solely at risk from having a high neutrophil/lymphocyte ratio (NLR). Risk factors for other mental conditions included being a woman, having diabetes, requiring oxygen assistance, or being mechanically ventilated. The most prevalent mental diseases in Post-Covid19 are irregular sleeping patterns, somatization, and anxiety. A similar association between the critical group and PTSD, anxiety, and psychosis exists. In post-COVID 19, age, those who are female, diabetic, oxygen-supported or mechanically ventilated, and have high NLR levels are more susceptible to mental illness.
Fu et al. 2021. [23]	Adult COVID-19 patients who were discharged between 1 February and 30 March 2020 were contacted by healthcare professionals at hospitals situated in five different Chinese cities. 199 finished the interview. Multiple linear regression models were fitted using the score on the single item of the Sleep Quality Scale as the dependent variable.	Among all individuals, 10.1% reported having horrible or bad sleep, 26.6% had acceptable sleep, 26.1% had poorer sleep as compared to before COVID-19, and 33.7% had been troubled by a sleeping issue in the previous two weeks. Witnessing the suffering or death of other COVID-19 patients during hospitalisation was a factor that was associated with poor sleep quality, as were depressive symptoms (adjusted B = 0.26, 95% CI = 0.31, 0.20), anxiety symptoms (adjusted B = 0.25, 95% CI = 0.33, 0.17) and post-traumatic stress disorders (adjusted B = 0.16, 95% CI = 0.22). Survivors of COVID-19 reported having trouble sleeping. COVID-19 survivors should get interventions and support services to enhance their sleep both while they are in the hospital and after they are released.

Author, Publishing Year	Methodology	Outcomes
Pedrozo-Pupo et al. 2022 [24]	Participants in cross-sectional research were 330 COVID-19 survivors. The Athens Insomnia Scale was used to measure insomnia (cut-off score: less than or equals to 6, Cronbach's alpha: 0.90).	COVID-19 survivors ranged in age from 18 to 89 (Mean = 47.7); the majority were women (61.5%), university-educated (62.4%), low-income (71.2%), married or in a free union (66.1%), not working in healthcare (85.8%), free of comorbidities (63.0%), asymptomatic or mild COVID-19 (66.1%), the duration of COVID-19 symptoms in less than three weeks (80.0%) and 60% of those who scored between 0 and 24 on the Athens Insomnia Scale (M = 7.3, SD = 5.1, Me = 7, IQR = 3–10) had insomnia. Post-traumatic stress disorder symptoms, COVID-19 symptoms for more than three weeks, female gender, and married or in a free union marital status were all linked to insomnia. Insomnia is common among COVID-19 survivors and is mostly associated with post-traumatic stress disorder, COVID-19 symptoms that have persisted for more than three weeks, and female gender. To determine if insomnia persists over time, follow-up investigations must be conducted.

IES-6 score for the n = 43 post-traumatic stress cases was 2.1 (54.4%). In Fact, according to Ahmed et al. [22] study, only 8.8% of people had no psychiatric symptoms, versus 91.2% who reported the following symptoms: psychoticism (17.6%), obsessive-compulsive disorder (OCD), obsessive-hyperactive disorder (PTSD), phobia-related anxiety (24.2%), somatization (41.8%), sadness (11.5%), anxiety (28%), as well as sleeplessness (64.8%). Risk factors for other mental conditions included being a woman, having diabetes, requiring oxygen assistance, or being mechanically ventilated (Table 1).

Discussion

Numerous investigations have shown as one of the signs, sleeplessness connected to chronic COVID. An analysis of 1733 patients' six-month follow-up data in China found that 26% of participants had sleeping problems as soon as utilising COVID - 19. 507 participants took part in a study using the Insomnia Severity Index to compare sleep problems across COVID-negative, Patients with COVID who are also post-COVID (ISI). The research's findings showed to individuals reported a considerably higher prevalence of sleeplessness when they had long-term COVID with a usually poorer standard of living (QOL). In a collection of post-COVID-19 cases 22% of patients who were assessed by ISI after being discharged from the University of Virginia ICU reported having insomnia for the first time during a six-week checkup [17, 25]. It is unusual that patients who recovered from COVID-19 to have considerably higher PSQI scores. Developing health problem that has to be explained among the other health issues that have followed the Disease. A particular viral genome type seen in the SARS-CoV-2 virus may be relevant in this situation. This Acute phase response is induced by double-stranded RNA viruses. That is carried out through interferon, an antiviral cytokine. The swift and early onset of this reaction is described as immune reactions to diseases and injuries [18]. There could be a variety of reasons for these people's poorer sleep. In a four-week follow-up, Mazza et al. [26] found that 28% of COVID-19 survivors had the prevalence of PTSD and 31% had anxiety, 42% experienced fear, and 40% had trouble sleeping. The mental health issues listed above are well-known sleep disruptors problems, as well as when they coexist for an extended length of time, insomnia develops. Additionally, illness heightens levels of stress that are already high because of persistent societal isolation issues, travel limitations, financial pressure, worries about COVID, and loneliness [17, 27–30]. Participants in one study with prolonged COVID-19 had shorter light and deep sleep intervals and longer awake sleep times. During sleep, the body secures restorative processes related to the immune system, cardiovascular system, and metabolism. Therefore, altering non-REM sleep phases could make it more likely that you'll get sick. It has also been shown that disturbed sleep architecture causes stress hormone levels to rise. These findings lend credence to the notion that COVID-19 may exhibit long-lasting symptoms, such as autonomic and neurologic abnormalities, particularly after the infection has ceased. This is consistent with the "Long COVID-19" condition, also known as "COVID-19 Brain Fog," which persists even after the first illness and is characterised by weariness, difficulty

concentrating, and sleep problems [20, 31–38]. Though the infection with SARS-CoV-2 is a recent fact and the fundamental processes of the body functioning in this illness require more exploration, patterns of alterations to the circadian rhythms have been investigated in many disorders. Long-term COVID-19 consequences are among the least researched topics. However, the assumption that patients with SARS-CoV-2 in the post-covid stage require long-term therapy due to a number of variables, including nervous system dysfunction, is supported by the available data. The ability to identify prognostic indicators for the disease in the future to effectively avoid long-term sequelae is made possible by the analysis of publications, which range from descriptions of clinical cases to literature reviews. According to recent prospective research, insomnia and obstructive sleep apnea are prevalent side effects of coronavirus infection, but they are also a strong predictor of poor outcomes in acute care facilities [39].

Conclusion

Our study included 8 studies in total. Patients with recovered COVID-19 showed a statistically significant prevalence of insomnia than control groups. Patients must be advised to follow up if they have trouble sleeping as a result. Early detection and treatment of people who are experiencing insomnia are crucial to prevent long-term harmful effects as increase in the intensity of depression, anxiety, and post-traumatic stress that were shown to be substantially correlated with poor sleep quality.

Conflict of Interest

None

Funding

None

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