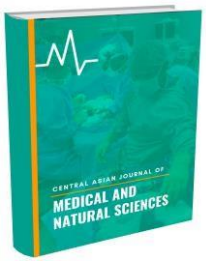

CENTRAL ASIAN JOURNAL OF MEDICAL AND NATURAL SCIENCES
https://cajmns.centralasianstudies.org/index.php/CAJMNS
Volume: 05 Issue: 02 | Mar 2024 ISSN: 2660-4159

Article

Post-Pandemic Sleep Disorders: Understanding Insomnia in the Aftermath of COVID-19

Neeran F. Hassan[1], Saba A. Ail[1], Ali S. Jabbar[1], Hanaa A. Abdulameer[1]

1. Science Laboratory Department, Pharmacy College, University of Al-Qadisiyah, Iraq
* Correspondence: Hanaa.Abduameer@qu.edu.iq

Abstract: Sleep issues after recovery have gotten a limited amount of investigation, despite the fact that the effects of COVID-19 are becoming more commonly understood. Students which had made a full recovery from COVID-19 were compared to individuals who had never been infected in order to determine the links between the between sleep interruptions and students who had recovered. In this research, both students evaluations were conducted on pupils who had recovered from COVID-19 as well as individuals who had never been infected again. The students were paired using age, gender, education and socioeconomic background. The study had a total of 110 participating students. In-between November of 2021 and March of 2022, students from the Pharmacy College and other colleges belonging to Al-Qadisiyah University were selected. A socio-demographic and clinical checklist was used together with the Pittsburgh Sleep Quality Index and the Hospital Anxiety Depression Scale in the interviews done with participants. Other measures used in this study include the Pittsburgh Sleep Quality Index and the Hospital Anxiety Depression Scale. However, fifty percent of those who recovered reported sleep problems whereas fifty percent of those that were nonrecoverable cases did not. A total of fifty-five percent (55/1110) of recovered COVID-19 students and one hundred percent (55/55) of control participants were found to have sleep disturbances, respectively. The recovered participants, with the exception of those who used medications, exhibited significantly higher levels of sleep instabilities across all domains that were measured by the Pittsburgh Sleep Quality Index questionnaire. This group of domains comprised There was a significant difference ($P < 0.001$) in the quality of sleep, latency, duration, efficiency, disruptions, and daytime dysfunction, as well as the overall PSQI score ($P \leqslant 0.001$). First, it was demonstrated that students suffering from covid 19 recovered have a worse subjective sleep quality and that major depressive symptoms did not contribute significantly to sleep measure and numerous researchers have agreed on the need for further researches in order to uncover the complex relationship between Covid 19 and sleep. 2.3%, confidence interval with a 95% rate: Some typical symptoms of the sleep disorder include are measures of sleep quality and some indicators of the hyperhidrosis and abnormal pandemic waters of the covid-19. The Covid-19's relationship to sleep difficulties is still a researchable area of concern as a possible consequence of COVID-19. This is because COVID-19 has the capacity to affect either the physical or the psychic that leads to the impairment of either psychic or physical functions.

Keywords: Corona virus, insomnia, pharmacy, depression, students

Citation: Hassan, N. F., Ail, S. A., Jabbar, A. S., & Abdulameer, H. A. Post-Pandemic Sleep Disorders: Understanding Insomnia in the Aftermath of COVID-19. Central Asian Journal of Medical and Natural Science 2024, 5(2), 72-81.

Received: 2nd March 2024
Revised: 11th March 2024
Accepted: 17th March 2024
Published: 24th March 2024

1. Introduction

The deadly corona virus was identified in Hubei's capital, Wuhan, China, late in 2019, and quickly brought the entire world to its knees. EUVUCORONAVYRUSA-2SARS-COV-2, often known as SARS, is a respiratory illness that, according to new discoveries, is caused by a severe acute respiratory syndrome [1], [2]. It was classified as a pandemic by

March 2020 by the World Health Organization (WHO) it was now a disease that impacted the whole world [3]. This led to a general consensus that the virus of the epidemic was passed on mainly through the path of respiratory droplets and transmission through close contact with the patient. Nevertheless, there is yet no information on this virus found to be highly contagious and can kill that serves as a virus now, and no full data can be firmly considered conclusive regarding its nature and its progression [4].

High rates of morbidity and mortality of COVID-19 cause an enormous numbers of people to be overwhelmed by higher levels of somatic and psychological distress, with symptoms of anxiety, sadness, and burnout related to the virus [5], [6]. Persons are affected drastically on their mental health and well-being due to the pandemic and as well as the detrimental effects on the economy, the social restrictions and lockdown procedures that were implemented in an effort to stop the virus from spreading [7]. A few recent studies show that COVID-19 infection can lead to such disorders as neuropsychiatric disease [8], which has the symptoms depression, anxiety, and disturbed sleep, among others. Symptoms of chronic allergic rhinitis are similar to those of severe acute respiratory syndrome and Middle East respiratory syndrome [9]. Interpretation of these findings was done because of previous epidemics, including Ebola virus. Many people have been known to have continued experiencing these post-recovery symptoms even after they were in stable condition. It was determined, during the 1-month follow-up, that one in every 5 patients treated in the hospital or under home isolation after the COVID-19 has at least one mental disorder: anxiety, depressive disorders, or post-traumatic stress disorder. This was evidenced in past year study that was undertaken in Italy. In contrast, even though COVID-19 patients show high prevalence of insomnia and other psychiatric symptoms (34%), there is some knowledge about psychopathological disabilities with patients in early recovery from COVID-19. Therefore, the objective of this study is to examine the causes and severity of sleep disturbances and to bring the potential risk factors associated with them in those who achieved recovery from COVID-19 and their counterparts who served as controls for the study.

2. Materials and Methods

2.1. Methodology

The study on the prevalence of insomnia syndrome was conducted on the months between 21st November 2021 to 29th March 2022. In turn, according to the WHO discharge criteria 15, cases established in a sequential manner by management of COVID-19 isolation hospitals is carried out under the supervision of Al-Qadisiyah University Committee for COVID-19 isolation hospitals. fixed n of COVID-19 survivors (n=100), n of COVID-19 survivors (n=55), and n of non-affected students released from the hospitals (n=55). COVID-19 was diagnosed based on the detection of viral nucleic acids in the nasopharyngeal swabs on the basis of that the patients were hospitalised or isolated at home. In order to function as a comparative group, an equivalent number of volunteers with no SARS-CoV-2 testing outcomes were enrolled in the study. These people were paired together because they were similar in terms of following aspects: age, gender, level of education, and social status. They were first-line relationships of survivors of COVID-19. The first-degree relatives of the pilot participants were selected for practice discrimination. Based on the use of the Epi Info 6.0, the sample size was calculated, under the assumption that the prevalence of the psychological symptoms among the COVID-19 respondents was 41%, whereas the same symptoms occurred in 21% of the general population [10]. This was achieved using a study with an 80 percent population and a 95% confidence level. One hundred and seventy of them were included in the research sample, of whom 85 had been diagnosed with COVID-19 and 85 were controls [11].

Individuals under the age of 18 and those people aged beyond 60 years, patients suffering from severe metabolic complications such as heart failure, renal failure, and hepatic failure in addition to mental illness, those who cannot read well, and also any volunteer who does not wish to participate in this selection procedure, were all compelled.

2.2. Data collection

Participants were made to fill a semi structured check list data was to be gathered pertaining the relevant socio - demographic along with the clinical data. The checklist did contain the following cues, for instance, about the age, gender, marital status, place of residence, level of education, working or not, and previous mental illness and/or medical illness of the individual. The subjects that have done a basic or secondary education fall within the low to medium educational level, whereas those who had a university or postgraduate education are classified as a high educational level.

2.3. Questionnaire

To ascertain whether our participants were afflicted by major acute or chronic primary mental disorders (for instance, psychosis, mental retardation, or dementia), we used the semi-structured tool, the Structured Clinical Interview for DSM-5 Axis I Disorders (SCID-5) [12]. This was done, in part, so that such conditions would not influence the results in case such conditions were present. The validity and reliability of this device have been demonstrated in several studies [13], [14]. Therefore, none of those who were the subjects of our investigation undergoing additional psychometric testing had a history of serious mental impairments. For anxiety and depression symptom characteristics, the Hospital Anxiety and Depression Scale as the self-reporting tool is enrolled. The DSM was analyzed by the Structured Clinical Interview at the time of carrying it out. The questionnaire includes seven questions concerning the symptoms of anxiety and depression with each one scored from one to three, known as Likert-scale. For each sub scale, there is a total score of the which the score could be anywhere between 0 and 2, and as a whole, the total score for each subscale is between 0 and 21 [15]. What it means is if an individual's score on this scale was below 11 points, then they were said to be having comorbid anxiety and depression symptoms. This scale was used in conjunction with a variation of an Arabic one that has been verified [16]. To quantify the symptoms of anxiety and depression, a self-reporting instrument called the Hospital Anxiety and Depression Scale is used. In applying the DSM, we relied on the Structured Clinical Interview. The questionnaire contains seven items related to the symptoms of anxiety and depression, which are rated according to a 0–3 point Likert scale. The subscale has a total score that can vary from 0 to 21 points [15]. In case the score of this scale for participant was less than 11 points, that meant they had comorbid anxiety or depression symptoms. A validated Arabic variation was used in combination with this scale [16].

2.4. Data Analysis

The Statistical Package for Social Sciences, version 20.0, was employed to carry out the analysis on the data. To compare the proportions of categorical data, the chi-square test was performed and, for the purpose of comparing the means of two groups for continuous variables, the independent sample t-test was applied. The CI of sleep interruptions in COVID-19 and control subjects were determined following the correction for the anxiety and depression symptoms that were associated with the condition. All the associations were considered as statistically significant, when the p-value was less than or equal to 0.05.

3. Results

A total of 120 recovered COVID-19 students were contacted. Ten percent refused to participate or could not complete the questionnaire. The study did not include students

who failed to complete the questionnaire and their control family accounts. Due to moderate to severe symptoms, fifty percent of those infected with COVID-19 were discharged from the hospital, and twenty-five percent of them isolated themselves under the influence of mild symptoms of the infection. Most of those who survived the COVID-19 infection population were students (52%); and this group had 10% of the married. Population average age of COVID-19 survivors - between 20 and 24 years, with SD equal to 6.40 years. The prevalence of stress and depressive symptoms was higher among recovered students as compared to the controls at 50%, with 55/110 and 100%, 55/55, and 8.3% for controls and the prevalence was found to be 10/120. Differences in socio-demographic and history of mental and medical conditions could not be considered statistically significant in this group, as well. Nevertheless, they did manage to survive. As to their control peers, the mean scores of people for stress and depression were significantly greater; the level was p ≤0.001 (Table 2).

Sleep disturbances occurred in 0.5 quintiles in recovered COVID-19 participants (55 students of 1,110) and 1 quintile in control participants (55 participants of 55). Except for the participants who used medications, we found that the participants recovering from PTSD were significantly more unstable on their sleep across all domains measured by the PSQI questionnaire. These domains were night sleep quality, latency, duration, wake time after sleep onset, efficiency, disturbances, daytime dysfunction (P λ0.001), and the global PSQI score (P λ0.001). The subjects have greater odds of having their sleep quality being deformed despite adjusting for the laid related anxiousness and depression symptoms. Students who had recovered from COVID-19 were more likely to have poor subjective sleep quality, with an odds ratio of 2.3 and a confidence interval of 95% respectively. A low global Pittsburgh Sleep Quality Index score among recovered individuals was associated with a number of symptoms, including a longer sleep latency (OR 4.6, 95%: Sleep time within the normal range (3.3-4.6), shorter sleep duration (OR 0. 5, [95% CI 0.5- 0.1], decreased sleep efficiency (OR 3.8, [2.0- 7.1]), frequent day time dysfunction (OR 3.0, [2.2- A further investigation of sleep difficulties as a sequel to COVID-19 is required. The reason for this is because COVID- 19 can lead to both mental and physical dysfunction.

Table 1. Sleep difficulties among recovered COVID-19 cases and controls

Variable	Cases (n = 55)	Controls (n = 55)	*SE*	*P*-value
	Mean (SD)	Mean (SD		
Quality of sleep	1.52 (0.98)	2.20 (0.97)	0.04	≤0.001
Latent sleep time	1.6 (0.93)	3.16 (1.00)	0.03	≤0.001
Time spent sleeping	1.22 (1.05)	2.68 (0.88)	0.02	0.002
Improved sleep quality	0.56 (0.88)	5.18 (0.41)	0.01	< 0.001
Disruptions to one's sleep	2.78 (0.66)	0.34 (0.68)	0.03	0.005
Intake of pharmaceuticals	4.22 (0.88)	0.01 (0.60)	0.13	0.002
Daytime dysfunction	2.13 (0.80)	0.6 (0.65)	0.02	< 0.001
Good (< 5)	22 (4.2)	45 (0.1)	0.16	< 0.001
Poor (≥ 5)	26 (7.6)	56 (8.9)	0.21	

Table 2. Scores of people for stress and depression

Variable	Cases (n = 55)	Controls (n = 55)	P-value
Age, mean (SD),	35.95 (6.40)	33.68 (9.37)	0.02
sex, indeed (%)			
A woman	24 (6.45)	62 (72.9)	
	36 (7.22)	23 (27.1)	
Male Sleeplessness%	67.4%	33%	0.002
Status of marriage, no. (%)			0.007
Got married	3.7(0.62)	66 (78)	
Do not marry	1.6 (0.15)	19 (22)	
No. of students,			0.001
College of Pharmacy	4.78 (0.3)	46 (54)	0.002
Medical school	2.5 (0.02)	39 (46)	0.002
College of Education	1.5(0.6)	12.3(0.4)	0.001
College of Science	3.2(0.7)	5.3(0.3)	0.005
College for vets	5.6 (7.2)	4.5(0.01)	0.001
There is no history of mental problems.			0.51
Yes	20 (8.1)	20 (3.22)	
No history of health problems, no. (%)	55 (0.6)	79 (5.1)	
HADS stands for "Yes No."			0.21
Feeling Down	11 (22)	11 (9.1)	
Stress and worry	35 (7.8)	35 (2.8)	
			0.001
Age, mean (SD),	13.24 (4.2)	`13.62 (0.8)	0.003
sex, indeed (%)	22.15 (6.3)	22.13 (3.3)	0.001

COVID-19: coronavirus disease 2021; HADS: Hospital Anxiety and Depression Scale; Significant at P ≤0.05.

4. Discussion

The main interpretation to reveal as a result of the study is that approximately fifty percent of the recovered COVID-19 students had sleeping problems in comparison to one hundred percent of the control group. Moreover, as compared to the controls, the recovered individuals had poorer PSQI scores overall, greater subjective sleep disorders, longer sleep latency, shorter sleep hours, lower sleep efficiencies, higher frequency of daytime dysfunction and lower sleep efficiencies overall. The post-remission period in the subject of research works on outbreak of the diseases points out at some mental morbidities' spectrum including sleep disorders with the variability between 10-35% [6], [17]. For instance, a study on sleep quality among 117 people from Nigeria showed that 35% of them, specif-

ically survivors of Ebola virus disease and family members of affected individuals, reported insufficient night sleep due to pandemic-related worries [18]. There was a Meta-analysis study that incorporated eight different studies where there were found sleep disruptions commonly among patients who were recovering from COVID19 in China, Turkey, and Italy respectively in 33%, 13%, and 50% cases [9]. It may also be due to psychological factors, as people may have experienced psychological restraints like social distancing, the psychological impact that a new virus that could cause high morbidity and mortality rates, fear of infection or of infecting others and stigma on the disease. However, the enhanced risk of psychological disorders, coupled with sleep issues, in those individuals who have been recovering from COVID infection than in those who have not been hit by COVID similarly but were under stress, suggests neuro-immunological possibilities of the virus. COVID-19 is very similar to SARS and MERS patients [19], [20], in that, it causes an activation potentially hyperactivation of T-helper-1 cell and a subsequent exaggeration of production of interferon-, interleukin IL-1, IL-6, CXCL10, and CCL2. As reference 29 itself explains, T-helper-2 cells have been activated in COVID-19 patients, leading to enhanced secretion of cytokines such as IL-4 and IL-10. Such activation that is observed in patients of COVID-19 is in sharp contrast to the patients of SARS and MERS where T-helper-2 cells got activated This induction of pro-inflammatory cytokines is the proof of their stimulus and the beginning of the mental symptoms [21]. As such, this can be furthered by the fact of the release of those cytokines. That coronaviruses are provided with the capability to infect the neurons via the attachment of the angiotensin-converting enzyme receptor 2 which is a protein generated by the neurons has been proved [22], [23], [24]. Having the coronavirus in the central nerve system or the brainstem that is responsible for controlling cardiorespiratory mechanics would therefore cause respiratory failure due to breathing complexities.

Nevertheless, psychopathies combined with sleep disorders, which were outlined in those people, who were recovering from COVID infection, while they had not caught the virus but were under pressure, are also the neuro-immunological possibilities of the virus. SARS and MERS patients had also similar characteristics of Covid-19 patients in that it resulted T-helper-1 cell activation maybe hyperactivation [19], [20] and increased production of interferon–, interleukin IL– -1, IL– -6, CXCL10, and CCL2 [25]. As tested by reference 29 itself, T-helper-2 cells activation occurs in COVID-19 patients that foster secretion of cytokines that include IL-4 and IL-ilo. As such, the activation said to observe in COVID-19 patients, poignantly contrasts with the patients of SARS and MERS where the T-help cable grain got initiation. This induction of excitement inflammation meta force is a signery of their inflammation in compo and the beginning of the brain systems [21]. Therefore, this can be augmented more by the release the cytokines. That the coronaviruses can be given with the ability to infect the neurons by attaching angiotensin-converting enzyme receptor 2 receptor that is made by the neurons has been verified; [22], [23], [24] having the virus point of the central neuromuscular or brainstem that controls the cardiorespiratory mechanics but causes.

Historically, clinical literature revealed a close nexus between the association of anxiety and depression with sleep disturbances [25]. As the research population in this study is constituted primarily by working adults, most of them were under employment. In the course of Covid-19, there is an argument that stress and anxiety of high levels were related to the poor quality of sleep, and the recoveries of people from the Covid-19 made one prone to the risk of negative health effects [26], [27]. It conceivable occurs alongside other physiological processes especially emotional and cognitive sensitivity that may have been caused by disturbance in emotional and cognitive capacities except that it also is left to bio-social frameworks, which includes cardiovascular, other hormonal, immunological, and metabolic processes such as behavior, attitude, and disposition of patients and caregivers towards their conditions. It can be that emotional issues may be the underlying cause of

long term or recurred episodes of deprivation and, conversely, deprivation may precipitate the onset of emotional difficulties [28].

In our research, particular limitations need to be considered. First of all, the study was cross-sectional, meaning we cannot prove any relationships between sleep problems and other risk factors such as COVID-19. However, because the students were drawn from Al-Diwaniya city and the sample size was small compared to other studies, the generalization of our results was greatly restricted. In spite of the fact that mentioned student information was a disease history case, the above case did not list a history of disease. Third, the outcomes were quantitatively measured using a self-rating scale for sleep duration disturbances. This might offer a biased basis for the calculation. This outcome implies that objective parameters, such as polysomnography, would produce more accurate and definite results.

5. Conclusion

Amongst the potential side effects of COVID-19, insomnia or sleep disturb should be addressed with more detailed attention because it may harm the mental and physical state of the person suffering from these issues. In this manner, female students might be able to prevail over or pre evade the appearance of similar problems because of prescribing individualized treatment for students who are falling asleep or most likely to have sleep issues caused by COVID-19. Therefore, population-based longitudinal study is required in order to studying the different psychological and neurobiological reasons that are related to sleep disorders and finding more individuals in Governorate Al-Diwaniya city who suffer from the COVID-19 squeals that lasts too long. Besides this, current studies have to focus on the physiological mechanisms of some anti-inflammatory markers that may be associated with the aetiology of COVID-19 and mental issues.

REFERENCES

[1] G. Qu, X. Li, L. Hu, and G. Jiang, *An imperative need for research on the role of environmental factors in transmission of novel coronavirus (COVID-19)*. ACS Publications, 2020. doi: 10.1021/acs.est.0c01102.

[2] V. K. Sharma, C. Jinadatha, and E. Lichtfouse, "Environmental chemistry is most relevant to study coronavirus pandemics," *Environ Chem Lett*, 2020, doi: 10.1007/s10311-020-01017-6.

[3] World Health Organization, "Director Generals opening remarks at the media briefing on COVID-19-March 11th.[Internet]. 2020." 2020.

[4] S. Liu *et al.*, "Online mental health services in China during the COVID-19 outbreak," *The Lancet …*, 2020, [Online]. Available: https://www.thelancet.com/journals/lanpsy/article/PIIS2215-0366(20)30077-8/fulltext

[5] …, S. Alharbi, R. Alshehri, E. M. Aldggag, A. T. Aljoudi, and ..., "Fear at the time of the COVID-19 pandemic: validation of the Arabic version of the Four-Dimensional Symptom Questionnaire among Saudi-based respondents," *BJPsych Open*, 2021, [Online]. Available: https://www.cambridge.org/core/journals/bjpsych-open/article/fear-at-the-time-of-the-covid19-pandemic-validation-of-the-arabic-version-of-the-fourdimensional-symptom-questionnaire-among-saudibased-respondents/5E1F4CED4BC9B2B308730DA41855DBFC

[6] M. Abdelghani, H. M. El-Gohary, E. Fouad, and ..., "Addressing the relationship between perceived fear of COVID-19 virus infection and emergence of burnout symptoms in a sample of Egyptian physicians …," *Middle East Current …*, 2020, doi: 10.1186/s43045-020-00079-0.

[7] S. Galea, R. M. Merchant, and N. Lurie, "The mental health consequences of COVID-19 and physical distancing: the need for prevention and early intervention," *JAMA Intern Med*, 2020, [Online]. Available: https://jamanetwork.com/journals/jamainternalmedicine/article-abstract/2764404

[8] J. P. Rogers, E. Chesney, D. Oliver, T. A. Pollak, and ..., "Psychiatric and neuropsychiatric presentations associated with severe coronavirus infections: a systematic review and meta-analysis with comparison to the …," *The Lancet …*, 2020, [Online]. Available: https://www.thelancet.com/journals/lanpsy/article/PIIS2215-0366(20)30203-0/fulltext

[9] J. Deng, F. Zhou, W. Hou, Z. Silver, and ..., "The prevalence of depression, anxiety, and sleep disturbances in COVID-19 patients: a meta-analysis," *Annals of the new …*, 2021, doi: 10.1111/Nyas.14506.

[10] J. Zhang, H. Lu, H. Zeng, S. Zhang, Q. Du, and ..., "The differential psychological distress of populations affected by the COVID-19 pandemic," *Brain, behavior, and …*, 2020, [Online]. Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7156946/

[11] E. Info, "6 (Version 6.04 d). Centers for Disease Control and Prevention, USA," *World Health Organization. Geneva, Switzerland*, 2001.

[12] M. B. First, "Structured Clinical Interview for the DSM (SCID)," *The encyclopedia of clinical psychology*, 2014, doi: 10.1002/9781118625392.wbecp351.

[13] F. L. Osório, S. R. Loureiro, J. E. C. Hallak, and ..., "Clinical validity and intrarater and test–retest reliability of the Structured Clinical Interview for DSM-5–Clinician Version (SCID-5-CV)," *Psychiatry and …*, 2019, doi: 10.1111/pcn.12931.

[14] S. A. Shankman, C. J. Funkhouser, and ..., "Reliability and validity of severity dimensions of psychopathology assessed using the Structured Clinical Interview for DSM-5 (SCID)," *… journal of methods …*, 2018, doi: 10.1002/mpr.1590.

[15] A. S. Zigmond and R. P. Snaith, "The hospital anxiety and depression scale," *Acta Psychiatr Scand*, 1983, doi: 10.1111/J.1600-0447.1983.Tb09716.X.

[16] O. El-Rufaie and G. Absood, "Validity study of the Hospital Anxiety and Depression Scale among a group of Saudi patients," *The British Journal of Psychiatry*, 1987, [Online]. Available: https://www.cambridge.org/core/journals/the-british-journal-of-psychiatry/article/validity-study-of-the-hospital-anxiety-and-depression-scale-among-a-group-of-saudi-patients/E68DF06A54E37D391850431F179E9758

[17] B. Sheng, S. K. W. Cheng, K. K. Lau, H. L. Li, and ..., "The effects of disease severity, use of corticosteroids and social factors on neuropsychiatric complaints in severe acute respiratory syndrome (SARS) patients at acute …," *European …*, 2005, [Online]. Available: https://www.cambridge.org/core/journals/european-psychiatry/article/effects-of-disease-severity-use-of-corticosteroids-and-social-factors-on-neuropsychiatric-complaints-in-severe-acute-respiratory-syndrome-sars-patients-at-acute-and-convalescent-phases/01D14CD214DB0AC0488C60770CEC20F9

[18] A. Mohammed, T. L. Sheikh, S. Gidado, G. Poggensee, and ..., "An evaluation of psychological distress and social support of survivors and contacts of Ebola virus disease infection and their relatives in Lagos, Nigeria: a …," *BMC Public Health*, 2015, doi: 10.1186/s12889-015-2167-6.

[19] M. J. Cameron, J. F. Bermejo-Martin, A. Danesh, M. P. Muller, and ..., "Human immunopathogenesis of severe acute respiratory syndrome (SARS)," *Virus Res*, 2008, [Online]. Available: https://www.sciencedirect.com/science/article/pii/S0168170207000548

[20] R. Channappanavar and S. Perlman, "Pathogenic human coronavirus infections: causes and consequences of cytokine storm and immunopathology," *Semin Immunopathol*, 2017, doi: 10.1007/s00281-017-0629-x.

[21] G. M. Arisi, "Nervous and immune systems signals and connections: cytokines in hippocampus physiology and pathology," *Epilepsy &Behavior*, 2014, [Online]. Available: https://www.sciencedirect.com/science/article/pii/S1525505014000304

[22] Y. C. Li, W. Z. Bai, and T. Hashikawa, "The neuroinvasive potential of SARS-CoV2 may play a role in the respiratory failure of COVID-19 patients," *J Med Virol*, 2020, doi: 10.1002/jmv.25728.

[23] R. Bhayana, A. Som, M. D. Li, D. E. Carey, M. A. Anderson, and ..., "Abdominal imaging findings in COVID-19: preliminary observations," *Radiology*, 2020, doi: 10.1148/radiol.2020201908.

[24] K. F. To and A. W. I. Lo, "Exploring the pathogenesis of severe acute respiratory syndrome (SARS): the tissue distribution of the coronavirus (SARS-CoV) and its putative receptor, angiotensin …," *The Journal of Pathology: A Journal of the …*, 2004, doi: 10.1002/path.1597.

[25] Q. Ye, B. Wang, and J. Mao, "The pathogenesis and treatment of theCytokine Storm'in COVID-19," *Journal of infection*, 2020, [Online]. Available: https://www.sciencedirect.com/science/article/pii/S0163445320301651

[26] H. Xiao, Y. Zhang, D. Kong, S. Li, and ..., "Social capital and sleep quality in individuals who self-isolated for 14 days during the coronavirus disease 2019 (COVID-19) outbreak in January 2020 in …," *Medical science monitor …*, 2020, [Online]. Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7111105/

[27] F. Borgonovi and E. Andrieu, "Bowling together by bowling alone: Social capital and Covid-19," *Social science &medicine*, 2020, [Online]. Available: https://www.sciencedirect.com/science/article/pii/S0277953620307206

[28] J. M. Mullington, M. Haack, M. Toth, J. M. Serrador, and ..., "Cardiovascular, inflammatory, and metabolic consequences of sleep deprivation," *Progress in …*, 2009, [Online]. Available: https://www.sciencedirect.com/science/article/pii/S0033062008000911

[29] M. G. Mazza, "COVID-19 BioB Outpatient Clinic Study group, Benedetti F. Anxiety and depression in COVID-19 survivors: Role of inflammatory and clinical predictors," *Brain Behav Immun.*, 2020, [Online]. Available: https://cir.nii.ac.jp/crid/1370857593780342025

[30] Y. Otsuka, Y. Kaneita, O. Itani, S. Nakagome, M. Jike, and ..., "Relationship between stress coping and sleep disorders among the general Japanese population: a nationwide representative survey," *Sleep Med*, 2017, [Online]. Available: https://www.sciencedirect.com/science/article/pii/S1389945717302575

[31] B. M. Altevogt and H. R. Colten, *Sleep disorders and sleep deprivation: an unmet public health problem*. books.google.com, 2006. [Online]. Available: https://books.google.com/books?hl=en&lr=&id=3bVTAgAAQBAJ&oi=fnd&pg=PT39&dq=sleep+disorders+and+sleep+deprivation+an+unmet+public+health+problem&ots=jwoTjioWJo&sig=xx2E8TPJ-qnNmvu1DqnpA9zq1MY

[32] E. K. Seng, C. Cervoni, J. L. Lawson, and ..., "The burden of sleep problems: A pilot observational study in an ethnically diverse urban primary care setting," *Journal of primary …*, 2016, doi: 10.1177/2150131916651068.

[33] V. K. Chattu, M. D. Manzar, S. Kumary, D. Burman, and ..., "The global problem of insufficient sleep and its serious public health implications," *Healthcare*, 2018, [Online]. Available: https://www.mdpi.com/2227-9032/7/1/1

[34] World Health Organization, "Criteria for releasing COVID-19 patients from isolation: scientific brief," *(No Title)*, 2020, [Online]. Available: https://cir.nii.ac.jp/crid/1370017282242848783

[35] D. J. Buysse, C. F. R. III, T. H. Monk, S. R. Berman, and ..., "The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research," *Psychiatry …*, 1989, [Online]. Available: https://www.sciencedirect.com/science/article/pii/0165178189900474

[36] K. H. Suleiman, B. C. Yates, A. M. Berger, and ..., "Translating the Pittsburgh sleep quality index into Arabic," *Western journal of …*, 2010, doi: 10.1177/0193945909348230.

[37] M. E. Dyken, T. Yamada, and H. A. Berger, "Transient obstructive sleep apnea and asystole in association with presumed viral encephalopathy," *Neurology*, 2003, doi: 10.1212/01.WNL.0000064166.82077.EB.

[38] S. Tasnim *et al.*, "Epidemiology of sleep disorders during COVID-19 pandemic: A systematic scoping review," *MedRxiv*, 2020, doi: 10.1101/2020.10.08.20209148.abstract.

[39] H. Jahrami, A. S. BaHammam, N. L. Bragazzi, and ..., "Sleep problems during the COVID-19 pandemic by population: a systematic review and meta-analysis," *… of Clinical Sleep …*, 2021, doi: 10.5664/jcsm.8930.

[40] K. Wu and X. Wei, "Analysis of psychological and sleep status and exercise rehabilitation of front-line clinical staff in the fight against COVID-19 in China," *Med Sci Monit Basic Res*, 2020, [Online]. Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7241216/

[41] M. A. Grandner, N. J. Jackson, V. M. Pak, and ..., "Sleep disturbance is associated with cardiovascular and metabolic disorders," *Journal of sleep …*, 2012, doi: 10.1111/j.1365-2869.2011.00990.x.