Evaluation of Sleep Quality in Patients with COVID-19 after Discharge

Sareh Mohammadi[1], Fatemeh Aghakhanbeigi[2], Narges Hoseini[2], Sajad Noorian[3],
Leili Yekefallah[4*]

1. *Department of Critical Care Nursing, School of Nursing and Midwifery, Alborz University of Medical Sciences, Karaj, Iran*
2. *Department of Critical Care Nursing, School of Nursing and Midwifery, Qazvin University of Medical Sciences, Qazvin, Iran*
3. *Department of the Statistics, School of Science, University of Qom, Qom, Iran*
4. *Department of Critical Care Nursing, Research Institute for Prevention of Non-Communicable Diseases, School of Nursing and Midwifery, Qazvin University of Medical Sciences, Qazvin, Iran*

Abstract

Background and Objective: This study examines sleep quality in patients with coronavirus disease 2019 (COVID-19) after recovery, exploring demographic associations to inform post-discharge management and support.

Materials and Methods: Conducted as a cross-sectional study, sleep quality was assessed in patients with COVID-19 2-4 weeks post-discharge in Iran. A two-part survey was administered via phone, capturing demographics and Pittsburgh Sleep Quality Index (PSQI) scores.

Results: Among 147 patients (109 women and 38 men, mean age: 47.9 years), the average PSQI score was 12.48 ± 7.37, with a mean sleep duration of 6.26 ± 1.69 hours. Poor sleep was notably linked to female gender (P = 0.029), unemployment (P = 0.012), and mental health history (P = 0.021).

Conclusion: Findings underscore the importance of monitoring sleep quality in COVID-19 recovery, with targeted support potentially reducing hospital readmissions.

Keywords: Sleep quality; COVID-19; Patient discharge

Introduction

On January 30, 2020, the World Health Organization (WHO) declared an international emergency due to the swift spread of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the virus responsible for coronavirus disease 2019 (COVID-19), which primarily affects the respiratory system (1). COVID-19 symptoms range widely from mild flu-like symptoms to severe respiratory distress requiring medical support (2). Although most patients with COVID-19 recover with only mild symptoms, approximately 20% experience severe complications that may require hospitalization and, in some cases, intensive care (3). The immediate clinical and epidemiological features of COVID-19 are well documented, but its long-term impacts are still not fully understood, necessitating further study (4). Persistent health issues lasting over a month post-infection, referred to as 'post-COVID conditions', are not yet thoroughly understood in terms of their causes and impacts. With many patients recovering at various stages of hospitalization, the global healthcare system faces a significant challenge (5). In an Italian study, 143 patients were observed seven weeks post-discharge, reporting symptoms such as fatigue (53%), shortness of breath (43%), and joint pain (27%) (6). Besides

* *Corresponding author*: *L. Yekefallah, Department of Critical Care Nursing, School of Nursing and Midwifery, Qazvin University of Medical Sciences, Qazvin, Iran*
Tel: +98 912 581 8173, Fax: +98 28 32237268
Email: leili_fallah@yahoo.com

tracking physical symptoms, it is crucial to also consider the psychological effects in patients with COVID-19, particularly with respect to sleep quality, a factor less frequently studied (7).

Sleep is a fundamental requirement for health and quality of life (QOL) across all ages (8). It is essential not only for general health but also for patients who are physiologically vulnerable following recovery from a severe illness (9). Clinical observations indicate that many patients have experienced sleep disturbances following quarantine treatment (10). In a study examining persistent symptoms and QOL post-discharge for COVID-19, limitations like a small patient group, single-center design, and high inaccessibility rates revealed sleep disturbances in 30.8% of patients (11).

Sleep disorders, which encompass inadequate duration, irregular timing, and poor quality, involve both quantitative and qualitative aspects such as sleep latency, motor and respiratory disruptions, duration, frequency of night awakenings, depth of sleep, and insomnia (12, 13). Quality sleep is particularly vital for the human body, strengthening the immune system and supporting essential physiological functions (14), with a notable interrelation between sleep and immune health (15). Poor sleep quality generally correlates with negative health outcomes, posing risks to disease recovery and potentially leading to various disorders (16-18). Inadequate sleep quality following recovery may compromise a patient's overall health (19). With the rise in discharged patients with COVID-19, tracking their health post-discharge and supporting their rehabilitation through quarantine becomes critically important (7). Thus, there is a need to further investigate the long-term consequences of COVID-19, especially in patients who have survived severe cases of the illness (20).

This study aims to assess sleep quality in patients with COVID-19 post-discharge.

Materials and Methods

This cross-sectional study focuses on patients recovering from COVID-19 after hospital discharge. With written consent from eligible participants based on inclusion criteria, sampling was conducted at Booali Sina and Velayat hospitals in Qazvin City, Iran, using a convenience method. Participants were briefed on the study goals and completed a demographic profile. Sleep quality data were gathered post-discharge (after 2-4 weeks) through phone interviews using the Pittsburgh Sleep Quality Index (PSQI).

The study inclusion criteria were as follows: 1) providing informed consent, 2) aged 18 to 60 years, 3) at least two weeks passed since COVID-19 diagnosis, and 4) being discharged following a COVID-19 diagnosis. Exclusion criteria included: 1) any pre-existing sleep disorders reported before contracting COVID-19, 2) medication use for mental or sleep-related issues, and 3) not being reached for follow-up.

Cohen's d was used to assess the correlation of sleep quality, with an effect size of r = 0.25, for a two-sided test at α = 0.05 (95% confidence level) and β = 0.15 (85% test power). Based on the following formula, a minimum sample size of 147 was calculated:

$$n_0 = \frac{(z_{1-\alpha/2} + z_{1-\beta})^2}{r^2} + 3$$

Considering a potential 10% dropout rate due to the specific challenges posed by this illness, the final target sample size was set at 164 participants. Out of 164 distributed questionnaires, 148 were complete, reflecting a 9% attrition rate. Data were collected by two researchers using a two-part questionnaire from May 25, 2021, to July 7, 2021, at the specified hospitals.

Data collection involved two questionnaire parts:

- **Part A:** A demographic questionnaire developed by researchers, covering age, gender, marital status, residence, education, employment status, lifestyle, underlying health conditions, and neurological history.
- **Part B:** The PSQI, designed by Daniel J. Buysse et al. in 1989, which assesses sleep across seven subscales, including mental sleep quality, sleep latency, duration, efficiency, sleep disturbances, use of sleep medication, and daily functional impact (21). Responses are rated on a four-point Likert scale (0-3), with scores ranging from 0 to 21. A higher score indicates poorer sleep quality, with scores above 5 denoting significant issues across at least two or moderate issues in more than three subscales. Buysse et al. established the questionnaire's internal consistency with a Cronbach's alpha of 0.83 (21).

Statistical analyses were performed using SPSS software (version 25, IBM Corporation, Armonk, NY, USA). Quantitative variables were

expressed as mean and standard deviation (SD). The chi-square test was applied to compare ratios across groups, while an independent samples t-test was used to compare means between two groups.

This project, a student research endeavor, received approval from Vice Chancellor for Research of Qazvin University of Medical Sciences with ethics code IR.QUMS.REC.1399.478.

Results

This study included 164 patients who were admitted to the COVID-19 ward between May 4 and July 17, 2021. Telephone follow-ups completed questionnaires for 147 patients, with 109 women (74%) and 38 men (25%), and an average age of 47.94 ± 11.98 years (range: 21-65 years). The average PSQI score recorded was 12.48 ± 7.37. Participants reported a mean sleep duration of 6.26 ± 1.69 hours, with a minimum of 2 hours and a maximum of 10 hours.

Poor sleep quality showed a significant association with female gender (P = 0.029), unemployment status (P = 0.012), and a history of mental health issues (P = 0.021) (Table 1).

There was a negative linear relationship between sleep quality score and sleep duration (correlation coefficient = -0.337, P < 0.001) (Figure 1).

Discussion

This is the first study in Iran to investigate post-discharge sleep quality in COVID-19 survivors. The PSQI is an established tool for diagnosing sleep quality issues and was employed here to assess sleep quality in patients with COVID-19 (7).

Table 1. Relationship between sleep quality and demographic information

Variable		n (%)	PSQI (mean ± SD)	P-value[*]
Gender	Women	109 (74)	13.25 ± 7.09	0.029
	Men	38 (25)	10.23 ± 7.79	
Marital status	Single	11 (7)	11.09 ± 8.23	0.550
	Married	134 (91)	12.52 ± 7.32	
	Divorced	2 (1)	16.50 ± 7.77	
Place of residence	Qazvin city	89 (60)	12.43 ± 7.88	0.572
	Countryside	46 (31)	13.08 ± 6.46	
	Village	12 (8)	10.41 ± 6.84	
Level of education	Illiterate	37 (25)	14.40 ± 6.58	0.329
	Under diploma	40 (27)	11.90 ± 6.11	
	Diploma	33 (22)	11.54 ± 8.18	
	University	37 (25)	12.00 ± 8.47	
Employment status	Employed	43 (29)	12.93 ± 8.38	0.012
	Unemployed	50 (34)	13.22 ± 7.32	
	Housewife	48 (32)	12.43 ± 6.20	
	Retired	6 (4)	3.33 ± 1.63	
Lifestyle	With spouse and children	85 (57)	11.47 ± 6.91	0.082
	With spouse	32 (21)	13.75 ± 8.96	
	With children	15 (10)	14.46 ± 4.37	
	Alone	6 (4)	18.16 ± 8.23	
	Others	9 (6)	10.33 ± 6.94	
Medical history	No	78 (53)	11.78 ± 7.66	0.215
	Yes	68 (46)	13.30 ± 7.04	
History of DM	No	116 (78)	12.56 ± 7.65	0.790
	Yes	31 (21)	12.16 ± 6.31	
History of HTN	No	119 (81)	12.32 ± 7.50	0.479
	Yes	27 (18)	13.44 ± 6.79	
History of hypothyroidism	No	134 (91)	12.56 ± 7.37	0.633
	Yes	13 (8)	11.53 ± 7.63	
History of hyperthyroidism	No	145 (98)	12.41 ± 7.38	0.340
	Yes	2 (1)	17.00 ± 7.07	
History of asthma	No	142 (96)	12.60 ± 7.44	0.250
	Yes	5 (3)	8.80 ± 3.42	
History of heart disease	No	123 (83)	12.08 ± 7.47	0.123
	Yes	24 (16)	14.50 ± 6.61	
History of neurological problems	No	135 (91)	12.05 ± 7.25	0.021
	Yes	12 (8)	17.25 ± 7.31	
History of hyperthyroidism	No	145 (98)	12.41 ± 7.38	0.340

[*]T-test was used to compare Pittsburgh Sleep Quality Index (PSQI) means in different groups
PSQI: Pittsburgh Sleep Quality Index; DM: Diabetes mellitus; HTN: Hypertension; SD: Standard deviation
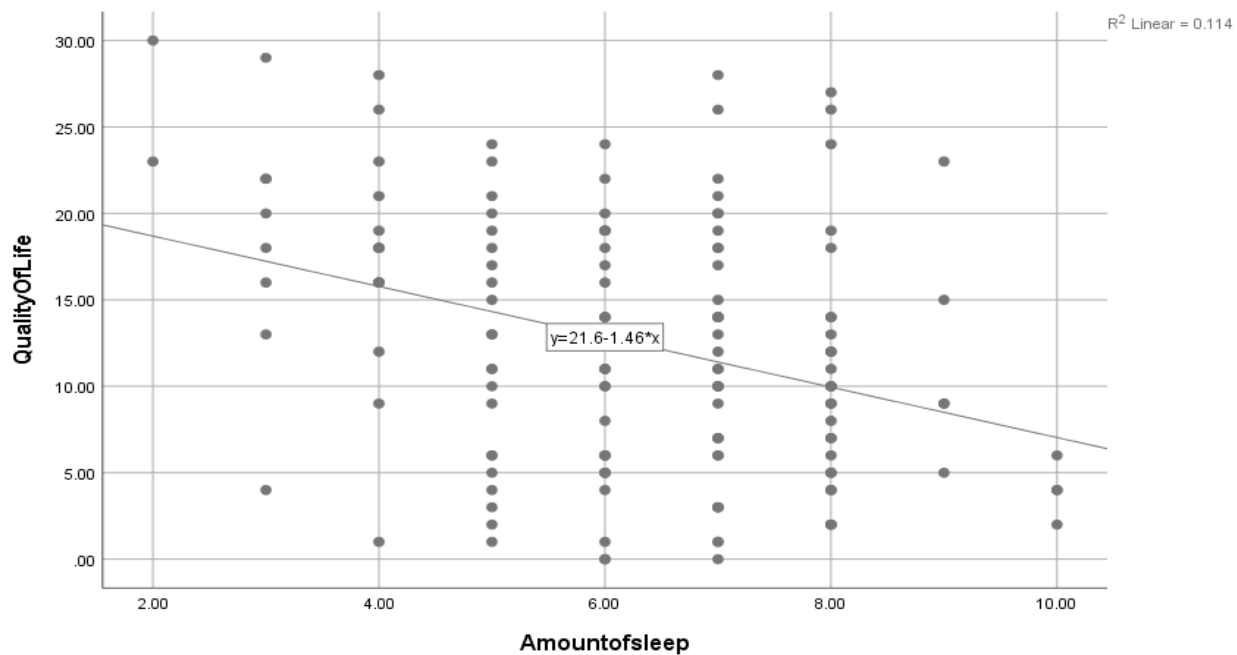
Figure 1. Distribution diagram of sleep quality and sleep duration

We observed that mean sleep quality scores were 12.48 ± 7.37, with scores above 5 indicating complaints related to sleep in the past month (22). The mean sleep duration of 6.26 ± 1.69 hours found in this study falls short of the 7-9 hours per night recommended by the National Sleep Foundation (NSF) for adults (23). Additionally, consistent with findings by Huang et al., sleep issues – lasting even six months post-diagnosis – were prevalent among COVID-19 survivors (4). These results suggest that early follow-up and appropriate symptom management could mitigate long-term complications (7).

The study also indicated that as sleep duration increased, the quality score improved, suggesting better sleep quality. However, a study by Blume et al. found that after quarantine in Austria, Germany, and Switzerland, sleep duration increased, yet quality declined due to lower physical and mental well-being (24). These differing results may stem from geographical and cultural factors, warranting further research in this area.

A significant relationship was also found between sleep quality and demographic factors. For instance, women reported significantly poorer sleep quality than men, aligning with studies indicating that the pandemic had a greater effect on sleep quality in women (25). Insufficient sleep or sleep disorders can impact women's daily lives, affecting roles in both the workforce and family

(26). Our findings are consistent with previous studies showing that women often report worse sleep quality (27). Franco et al. further emphasized that gender differences in sleep quality began in childhood and persisted through adulthood, with girls more likely than boys to face sleep issues (28).

Employment status also correlated with sleep quality, as unemployed individuals had higher sleep scores, echoing Maeda et al., which linked unemployment to increased insomnia (29). With COVID-19-related job loss, particularly in high-risk professions, sleep issues have become more prevalent, notably among those facing significant employment challenges (30, 31). Research in Italy also found heightened sleep problems linked to COVID-19, particularly among individuals reporting job-related stress (32).

In this study, participants with conditions such as high blood pressure, hyperthyroidism, asthma, heart disease, or neurological issues reported more sleep disturbances and higher PSQI scores. Studies similarly noted that older individuals with chronic diseases faced greater sleep challenges (33). Additionally, participants with a history of neurological issues reported significantly poorer sleep quality. This aligns with recent research showing that patients with COVID-19 with prior mental health issues had an elevated risk of insomnia (34).

Limitations: One limitation of this study was the relatively small sample size of 147 patients. As

the first Iranian study examining post-discharge sleep quality in COVID-19 survivors after one month, its conclusions should be interpreted cautiously. Further research with larger sample groups is recommended to validate these findings.

Conclusion

The findings of this study highlight the need to enhance sleep and mental health support for COVID-19 survivors, with a particular focus on women, the unemployed, and those with pre-existing conditions. This research offers valuable insights into sleep quality in patients with COVID-19 post-recovery, which can guide diagnosis, treatment, and prevention of sleep disorders.

Conflict of Interests

Authors have no conflict of interests.

Acknowledgments

References

1. Velavan TP, Meyer CG. The COVID-19 epidemic. Trop Med Int Health 2020; 25: 278-80.

2. Wu Z, McGoogan JM. Characteristics of and important lessons from the coronavirus disease 2019 (COVID-19) outbreak in China: Summary of a Report of 72 314 cases from the Chinese Center for Disease Control and Prevention. JAMA 2020; 323: 1239-42.

3. Shah S, Majmudar K, Stein A, et al. Novel Use of Home pulse oximetry monitoring in COVID-19 patients discharged from the emergency department identifies need for hospitalization. Acad Emerg Med 2020; 27: 681-92.

4. Huang C, Huang L, Wang Y, et al. 6-month consequences of COVID-19 in patients discharged from hospital: a cohort study. Lancet 2021; 397: 220-32.

5. Centers from Disease Control and Prevention. Available from: https://www.cdc.gov/coronavirus/2019-ncov/long-term-effects.html

6. Halpin SJ, McIvor C, Whyatt G, et al. Postdischarge symptoms and rehabilitation needs in survivors of COVID-19 infection: A cross-sectional evaluation. J Med Virol 2021; 93: 1013-22.

7. Huang S, Zhuang W, Wang D, et al. Persistent somatic symptom burden and sleep disturbance in patients with covid-19 during hospitalization and after discharge: A prospective cohort study. Med Sci Monit 2021; 27: e930447.

8. Zeitlhofer J, Schmeiser-Rieder A, Tribl G, et al. Sleep and quality of life in the Austrian population. Acta Neurol Scand 2000; 102: 249-57.

9. Altman MT, Knauert MP, Pisani MA. Sleep disturbance after hospitalization and critical illness: A systematic review. Ann Am Thorac Soc 2017; 14: 1457-68.

10. Liu K, Chen Y, Wu D, et al. Effects of progressive muscle relaxation on anxiety and sleep quality in patients with COVID-19. Complement Ther Clin Pract 2020; 39: 101132.

11. Garrigues E, Janvier P, Kherabi Y, et al. Post-discharge persistent symptoms and health-related quality of life after hospitalization for COVID-19. J Infect 2020; 81: e4-e6.

12. Laposky AD, Van CE, Diez-Roux AV. Reducing health disparities: The role of sleep deficiency and sleep disorders. Sleep Med 2016; 18: 3-6.

13. Sonka K, Sos P, Susta M. Past and present in drug treatment of sleep disorders. Neuro Endocrinol Lett 2014; 35: 186-97.

14. Rana M, Riffo AC, Mesa LT, et al. Sleep in children: physiology and update of a literature review. Medicina (B Aires) 2019; 79(Suppl 3): 25-8. [In Spanish].

15. Besedovsky L, Lange T, Haack M. The sleep-immune crosstalk in health and disease. Physiol Rev 2019; 99: 1325-80.

16. Loef B, van Baarle D, van der Beek AJ, et al. Shift work and respiratory infections in health-care workers. Am J Epidemiol 2019; 188: 509-17.

17. Prather AA, Janicki-Deverts D, Hall MH, et al. Behaviorally assessed sleep and susceptibility to the common cold. Sleep 2015; 38: 1353-9.

18. Dehghankar L, Ghorbani A, Yekefallah L, et al. Association of sleep quality with socio-demographic characteristics in elderly referred to health centers in Qazvin, Iran. Sleep Hyp 2018; 20: 227-32.

19. Asif N, Iqbal R, Nazir CF. Human immune system during sleep. Am J Clin Exp Immunol 2017; 6: 92-6.

20. Polese J, Sant'Ana L, Moulaz IR, et al. Pulmonary function evaluation after hospital discharge of patients with severe COVID-19. Clinics (Sao Paulo) 2021; 76: e2848.

21. Namdar P, dehghankar L, Yekefallah L. The effect of hatha yoga on low back pain and sleep quality in nulliparous pregnant women: A clinical trial study. Practising Midwife 2021; 24(7): 1-18.

22. Mollayeva T, Thurairajah P, Burton K, et al. The Pittsburgh sleep quality index as a screening tool for sleep dysfunction in clinical and non-clinical samples: A systematic review and meta-analysis. Sleep Med Rev 2016; 25: 52-73.

23. Hirshkowitz M, Whiton K, Albert SM, et al. National Sleep Foundation's sleep time duration recommendations: methodology and results summary. Sleep Health 2015; 1: 40-3.

24. Blume C, Schmidt MH, Cajochen C. Effects of the

COVID-19 lockdown on human sleep and rest-activity rhythms. Curr Biol 2020; 30: R795-R797.

25. Alimoradi Z, Gozal D, Tsang HWH, et al. Gender-specific estimates of sleep problems during the COVID-19 pandemic: Systematic review and meta-analysis. J Sleep Res 2022; 31: e13432.

26. Trapp GS, Hurworth M, Jacoby P, et al. Energy drink intake is associated with insomnia and decreased daytime functioning in young adult females. Public Health Nutr 2021; 24: 1328-37.

27. Mallampalli MP, Carter CL. Exploring sex and gender differences in sleep health: a Society for Women's Health Research Report. J Womens Health (Larchmt) 2014; 23: 553-62.

28. Franco P, Putois B, Guyon A, et al. Sleep during development: Sex and gender differences. Sleep Med Rev 2020; 51: 101276.

29. Maeda M, Filomeno R, Kawata Y, et al. Association between unemployment and insomnia-related symptoms based on the Comprehensive Survey of Living Conditions: A large cross-sectional Japanese population survey. Ind Health 2019; 57: 701-10.

30. Bagheri Sheykhangafshe F, Hojjat Shamami M. Sleep Quality during coronavirus-2019 pandemic. Int Clin Neurosci J 2021; 8: 105-6.

31. Liu S, Heinzel S, Haucke MN, et al. Increased psychological distress, loneliness, and unemployment in the spread of COVID-19 over 6 months in Germany. Medicina (Kaunas) 2021; 57.

32. Gualano MR, Lo MG, Voglino G, et al. Effects of covid-19 lockdown on mental health and sleep disturbances in Italy. Int J Environ Res Public Health 2020; 17.

33. Jiang Z, Zhu P, Wang L, et al. Psychological distress and sleep quality of COVID-19 patients in Wuhan, a lockdown city as the epicenter of COVID-19. J Psychiatr Res 2021; 136: 595-602.

34. Orru G, Bertelloni D, Diolaiuti F, et al. Long-COVID syndrome? A study on the persistence of neurological, psychological and physiological symptoms. Healthcare (Basel) 2021; 9: 5.