Article published online: 2023-09-11

Sleep Quality, Excessive Daytime Sleepiness, and Physical Activity Level in Health Professionals with and Without COVID-19: a Cross-Sectional Study

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Sleep Sci 2023;16(3):e294–e299.

Abstract

Objective To compare the sleep quality, excessive daytime sleepiness, and physical activity level in health professionals infected and not infected with COVID-19.

Methods Cross-sectional study based on online forms (Google Forms) filled out by health professionals who cared for COVID- 19 patients in hospitals in the Recife metropolitan area, Brazil, between October 2020 and May 2021. Anthropometric, sociodemographic, and occupational data were collected, along with the assessment of excessive daytime sleepiness (with Epworth Sleepiness Scale [ESE]), sleep quality (with Pittsburgh Sleep Quality Index [PSQI]), and physical activity level (with International Physical Activity Questionnaire [IPAQ] – short version).

Results A total of 96 participants were assessed (37 with COVID-19, 59 without COVID-19). There were no differences between the groups regarding physical activity levels classified as sedentary, moderately active, or highly active ($p = 0.850$), or the weekly energy expenditure ($p = 0.522$). Infected professionals had a greater workload than non-infected ones, besides poorer sleep quality (10.46 ± 3.75 vs. 7.88 ± 3.75; $p = 0.001$) and excessive daytime sleepiness (10.19 ± 3.05 vs. 8.44 ± 3.85; $p = 0.016$).

Conclusion Based on the results, this study shows that professionals infected with COVID-19 have poorer sleep quality, associated with excessive daytime sleepiness, in contrast with non-infected professionals.

Keywords
- sleep
- physical activity
- health professionals
- COVID-19
- sleepiness

Introduction

As the pandemic evolved and the number of cases sharply increased, frontline health professionals fighting against COVID-19 faced additional workload and pressure.[1] They dealing directly and indirectly with the pandemic were exposed daily to a great risk of getting sick themselves.[2] The high contamination rate is related to challenges in acquiring, wearing, and handling personal protective equipment (PPE).[3] Once infected, professionals must get isolated to

received May 30, 2022
accepted December 5, 2022

DOI https://doi.org/10.1055/s-0043-1772807.
ISSN 1984-0659.

Thieme Revinter Publicações Ltda., Rua do Matoso 170, Rio de Janeiro, RJ, CEP 20270-135, Brazil

prevent infecting their workmates, patients, and relatives, overloading the teams and causing high levels of anxiety and distress. Such a scenario greatly fatigues workers, causing physical and mental diseases, stress, and poor quality of life and sleep.[4]

Recent studies demonstrated a decrease in the sleep quality of individuals infected with COVID-19; however, its mechanisms have not been fully clarified yet.[5,6] Insomnia has been diagnosed more often in post-COVID-19 patients than in non-infected people.[7] Furthermore, the sleep of infected patients has poor quality, is less efficient and shows lower latency and duration and higher fragmentation, causing daytime dysfunction and possibly lasting up to 6 months after COVID-19 symptoms onset[8,9].

Besides sleep impairment, social distancing, and confinement – which were essential to reduce COVID-19 dissemination – decreased the levels of physical activity in the general population.[10,11] It was likewise decreased in infected people, due to both isolation and muscle fatigue caused by the disease.[12]

Hence, frontline health professionals fighting the COVID-19 pandemic not only have to cope with increased workload and stress and anxiety levels but also the infection with this virus may affect their sleep and physical activity. Therefore, the objective of this study was to compare the sleep quality, excessive daytime sleepiness, and physical activity level in health professionals with and without COVID-19.

Material and Methods

Study Design and Participants

This is an observational cross-sectional study based on online forms filled out in Google Forms by 96 participants (37 with COVID-19, 59 without COVID-19). Data were collected from October 2020 to May 2021, upon approval by the Human Research Ethics Committee of the Federal University of Pernambuco (UFPE) in September 2020, under evaluation report number 4.289.462.

The research inclusion criteria were as follows: health professionals (physicians, physical therapists, nurses, and nurse assistants) who cared for COVID-19 patients in hospitals in the Recife metropolitan area, in Pernambuco, Brazil, with no restriction on sex or age. The following were the exclusion criteria: professionals who worked in departments that did not receive COVID-19 patients or who had been on a leave of absence for more than 30 days at the time of the research.

Data Collection

Participants were recruited via publicization of the research in digital media and indication by other research participants. The participants were invited to the survey using Google Forms platform under the Free Informed Consent Term (FICT), pursuant to resolution 466/2012 of the National Health Council, and answered questions on personal, anthropometric, sociodemographic, and occupational information and validated questionnaires on excessive daytime sleepiness (Epworth Sleepiness Scale – ESE), sleep quality (Pittsburgh Sleep Quality Index – PSQI), and physical activity level (International Physical Activity Questionnaire – IPAQ), minimizing the risk of measurement bias.

Epworth Sleepiness Scale (ESE)

ESE has been validated, translated, and adapted for use in Brazil. It assesses excessive daytime sleepiness by evaluating whether one is likely to fall asleep in eight everyday situations, thus identifying people rather prone to having excessive daytime sleepiness. The total score can reach up to 24 points, and subjects are classified as sleepy if their score is $\geq$ 10 points.[13]

Pittsburgh Sleep Quality Index (PSQI)

PSQI subjectively assesses sleep quality regarding the previous month. The questionnaire – which has been validated, translated, and adapted for use in Brazil – has 19 self-assessment questions that classify sleep quality as good or poor. The overall score ranges from 0 to 21 points, stratifying sleep quality as either good ($<$ 5) or poor ($\geq$ 5).[14]

International Physical Activity Questionnaire (IPAQ)

IPAQ, which has been validated and translated for use with the Brazilian population, assesses the physical activity level in the previous week. The instrument estimates the weekly time spent in mild, moderate, and vigorous physical activities, as well as walking and sitting. Hence, it classifies people into physically inactive, moderately active, and highly active and calculates their energy expenditure in MET-minute/week.[15]

Sample Size

The sample size was calculated with GPOWER statistical package software, version 3.1.3 (Franz Faul; Universität, Kiel, Germany), with a 0.3 effect size, 95% significance level, and 80% study power, reaching a total sample size of 72 individuals (36 in each group).

Statistical Analysis

Data were analyzed in the Statistical Package for the Social Sciences (SPSS), version 20.0. The means $\pm$ standard deviations (SD) and percentages (%) of the variables were calculated. The statistical significance level was set at $p \leq 0.05$. Normality was analyzed with the Kolmogorov– Smirnov test. Continuous quantitative variables were compared between the groups with the Mann-Whitney test (for non-normal distribution) and the independent sample T-test (for normal distribution); as for the qualitative variables, the Fisher exact test (when there were fewer than five cases per cell) and chi-square test (for the remaining ones) were used.

Results

Sample characterization is presented in ►**Table 1**. There were no differences between the groups with and without COVID-19, except for weekly workload ($p = 0.013$). Professionals who had been contaminated with COVID-19 had a greater workload than those who had not been contaminated with the disease.

Table 1 Sample characteristics

	COVID-19 Positive (n = 37)	COVID-19 Negative (n = 59)	p-value
Age (years)	31.70 ± 7.96	31.97 ± 7.52	0.871
Sex			0.973
Males (n/%)	7 (38.9%)	11 (61.1%)	
Females (n/%)	30 (38.5%)	48 (61.5%)	
Weight (kg)	70.84 ± 14.65	69.02 ± 15.88	0.574
Height (m)	1.64 ± 0.08	1.64 ± 0.10	0.925
BMI (kg/m^2)	26.10 ± 4.94	25.38 ± 4.78	0.477
Occupation			0.059
Physicians (n/%)	3 (25%)	9 (75%)	
Physical therapists (n/%)	15 (34.9%)	28 (65.1%)	
Nurses (n/%)	12 (66.7%)	6 (33.3%)	
Nurse assistants (n/%)	7 (30.4%)	16 (69.6)	
Health service			0.163
Private (n/%)	6 (75%)	2 (25%)	
Public (n/%)	20 (37%)	34 (63%)	
Mixed (public and private in the same service) (n/%)	5 (38.5%)	8 (61.5%)	
Both (public and private in different services) (n/%)	6 (28.6%)	15 (71.4%)	
Work schedule			0.832
Daily (4, 6, or 8 hours a day) (n/%)	6 (42.9%)	8 (57.1%)	
12-hour shifts (n/%)	24 (39.3%)	37 (60.7%)	
Both (n/%)	7 (33.3%)	14 (66.7%)	
work shift			0.980
Daytime (n/%)	12 (40%)	18 (60%)	
Nighttime (n/%)	3 (37.5%)	5 (62.5%)	
Both (n/%)	22 (37.9%)	36 (62.1%)	
Weekly workload (hours)	61.24 ± 22.69	51.15 ± 16.38	0.013**
Comorbidities (yes) (n/%)	9 (69.2%)	4 (30.8%)	0.057
Asthma (n/%)	4 (80%)	1 (20%)	
Diabetes Mellitus (n/%)	1 (50%)	1 (50%)	
SAH (n/%)	4 (66.7%)	2 (33.3%)	
Medication (yes) (n/%)	8 (66.7%)	4 (33.3%)	0.09
Antidepressants (n/%)	6 (66.7%)	3 (33.3%)	
Anxiolytics (n/%)	2 (66.7%)	1 (33.3%)	

Data are presented in absolute numbers (percentage) and means ± standard deviations. SAH = systemic arterial hypertension, BMI = body mass index; # Fisher exact test. χ^2 chi-square test.
*Mann-Whitney test $p < 0.05$.
**T- test $p < 0.05$.

The comparison of the physical activity levels between health professionals with and without COVID-19 is shown in ►**Table 2**. There were no differences between the groups regarding either the weekly energetic expenditure ($p = 0.522$) or the physical activity levels, classified as sedentary, moderately active, and highly active ($p = 0.850$).

►**Table 3** compares PSQI components, sleep quality, and excessive daytime sleepiness between health professionals with and without COVID-19. In the comparison of PSQI components between the groups, subjective sleep quality ($p = 0.01$), presence of sleep disorders ($p = 0.014$), use of sleeping medication ($p = 0.047$), and daytime dysfunction ($p = 0.001$) obtained higher values in the group of professionals infected with COVID-19. This group also had a poorer sleep quality ($p = 0.001$) and excessive daytime sleepiness ($p = 0.016$).

Table 2 Comparison of physical activity levels between health professionals with and without COVID-19

Variable	COVID-19 Positive (n = 37)	COVID-19 Negative (n = 59)	P-value (Mann- Whitney)	DM (95% CI)
IPAQ (MET-min/week)	2097.00 (2844.00)	1965.00 (2666.00)	0.522	328.70 (- 1451.70 to 794.29)
IPAQ (Sedentary)	9 (34.6%)	17 (65.4%)		
IPAQ (Moderately Active)	11 (42.3%)	15 (57.7%)	0.850#	
IPAQ (Highly Active)	17 (38.6%)	27 (61.4%)		

IPAQ= International Physical Activity Questionnaire. # Fisher exact test. χ^2 chi-square test.
*Mann-Whitney test $p < 0.05$
**T- test $p < 0.05$

Table 3 Comparison of PSQI components, PSQI total score, and ESE between health professionals with and without COVID-19

Variable	COVID-19 Positive (n = 37)	COVID-19 Negative (n = 59)	P-value (T-test)	DM (95% CI)
PSQI subjective sleep quality (C1)	2 (1)	1 (1)	0.01*	0.42 (0.74 to 0.10)
PSQI sleep latency (C2)	2 (2)	1 (1)	0.121	0.35 (-0.79 to 0.94)
PSQI sleep duration (C3)	2 (0)	2 (1)	0.081	0.33 (-0.70 to 0.04)
PSQI habitual sleep efficiency (C4)	1 (2)	0 (1)	0.127	0.31 (-0.72 to 0.09)
PSQI sleep disorders (C5)	2 (1)	1 (1)	0.014*	0.33 (0.60 to 0.07)
PSQI use of sleeping medication (C6)	0 (1)	0 (0)	0.047*	0.43 (0.86 to 0.007)
PSQI daytime dysfunction (C7)	2 (1)	1 (1)	0.021*	0.38 (0.70 to 0.05)
PSQI total score	10.46 ± 3.75	7.88 ± 3.75	0.001**	2.57 (4.14 to 1.01)
PSQI poor sleep quality (≥ 5 points)	34 (41%)	49 (59%)		
PSQI good sleep quality (< 5 points)	3 (23.1%)	10 (76.9%)		
Excessive daytime sleepiness (ESE score)	10.19 ± 3.05	8.44 ± 3.85	0.016**	1.74 (3.15 to 0.33)
Excessive daytime sleepiness (ESE > 10)	19 (46.3%)	22 (53.7%)		
Absence of excessive daytime sleepiness (ESE < 10)	18 (32.7%)	37 (67.3%)		

PSQI = Pittsburgh Sleep Quality Index; ESE = Epworth Sleepiness Scale. Values presented in medians (interquartile range), means ± standard deviation, and absolute numbers (percentages). # Fisher exact test. χ^2 chi-square test
*Mann-Whitney test $p < 0.05$
**T- test $p < 0.05$

Discussion

The objective of this study was to compare the sleep quality, excessive daytime sleepiness, and physical activity level in health professionals with and without COVID-19. No difference was found between health professionals with and without COVID-19 regarding weekly energy expenditure and physical activity level. On the other hand, professionals who had been contaminated had a poorer sleep quality and excessive daytime sleepiness in comparison with non-contaminated ones.

A paper by Tran et al. (2020)[16] corroborates the data found in this study, in that there were no differences between health professionals with and without COVID-19 regarding their physical activity level. In the study, conducted with health professionals in Vietnam, most research participants reported not having changed their physical activity level during the COVID- 19 pandemic.[17] This may be explained by the intensive workloads and shifts experienced by health professionals during the COVID-19 pandemic, helping maintain a high level of physical activity.[7,18]

Sleep quality was poor in both study groups, though even poorer in the group of those infected with COVID-19. Such a result in the present paper corroborates the study by Bozan et al. (2021),[7] conducted with health professionals in Turkey. They demonstrated that the sleep quality after COVID-19 infection was poorer than before the disease. Another study, conducted in Egypt by Omar DI et al. (2022),[19] assessed the sleep quality of nurses during the COVID-19 pandemic and likewise found it to be poor – which was even poorer in those who had COVID-19. This may be explained by the heavy workloads, extenuating shifts, and unstable working conditions. They are constantly under great psychological pressure, which causes high stress levels and poorer sleep quality.[4] As both groups had been exposed to such factors, the poorer sleep quality in the infected group is justified.

The poorer sleep quality in the infected group is believed to be due to the possible presence of SARS-CoV-2 in the brain of those with COVID-19. The presence of the virus in the brain causes a cytokine storm and endothelial inflammation, impairing the integrity of the hematoencephalic barrier and favoring the development of sleep disorders.[20] Moreover, the inflammatory cascade is directly influenced by the circadian rhythm; therefore, people whose circadian rhythm is dysregulated, such as health professionals, may be more susceptible to various infections and clinical manifestations.[21]

The infected group had higher values in the following PSQI components: subjective sleep quality (C1), presence of sleep disorders (C5), use of sleeping medication (C6), and daytime dysfunction (C7). The study by Omar DI et al. (2022)[19] found changes mainly in sleep duration, sleep latency, sleep effectiveness, and (like in our study) the presence of sleep disorders. However, the said study did not divide participants into infected and non-infected groups. The infected group presents with physiological changes in the brain, with increased local inflammation. This compromises the hematoencephalic barrier, favoring the presence of sleep disorders and decreasing the sleep quality – which explains the results obtained in this study.[20] In the present paper, health professionals infected with COVID-19 also had excessive daytime sleepiness. A study conducted in Turkey with recovered patients assessed excessive daytime sleepiness among other symptoms and found that most patients had poor sleep quality and daytime sleepiness. The results of this study suggest that excessive daytime sleepiness may be a persistent symptom in patients after COVID-19 infection.[22] San Martin et al. (2020)[23] demonstrated that health professionals had a poor sleep quality during the COVID-19 pandemic. On the other hand, this study did not find excessive daytime sleepiness, which may be explained by a great incidence of insomnia in this population, decreasing sleep quality without causing excessive daytime sleepiness. These results also explain why the group of health professionals non-contaminated with COVID-19 had poor sleep quality without excessive daytime sleepiness in the present study.

The main limitation of this study was that the questionnaire responses were given online by the volunteers, which may have influenced the data. Nevertheless, this was the safest way to conduct the research assessment, given the need to keep social distance and respect the protocols to reduce contagion and contamination. Another aspect to point out is the definition of COVID-19 severity experienced by the contaminated group, which could better stratify the conditions and possible sequelae of the disease. Such a stratification was not made in the present study because it was self-reported online research, conducted not necessarily when the volunteers were still infected with COVID-19. Hence, it was not possible to collect clinical data on severity markers.

Conclusion

This study demonstrated that health professionals contaminated with COVID-19 had a heavier workload, poorer sleep quality, and excessive daytime sleepiness, in contrast with health professionals who had not been infected. However, there were no differences in weekly energy expenditure and physical activity level between health professionals with and without COVID-19.

Further studies on the topic should be made, addressing the long-term consequences of COVID-19 in this population, as well as an objective analysis to provide more reliable data on the variables related to sleep quality, excessive daytime sleepiness, and physical activity. Moreover, studies addressing associations between the SARS-CoV-2 mechanism of action in the brain and sleep parameters and physical activity level could be helpful to clarify this question.

Financial Disclosure Statement
This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – Brasil (CAPES) – Finance Code 001

Conflict of Interest
None declared.

References

1 Wu K, Wei X. 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;26: e924085–e1. Doi: 10.12659/MSMBR.924085
2 Teixeira CFS, Soares CM, Souza EA, et al. The health of healthcare professionals coping with the Covid-19 pandemic. Cien Saude Colet 2020;25(09):3465–3474. Doi: 10.1590/1413-81232020259.19562020
3 Ranney ML, Griffeth V, Jha AK. Critical Supply Shortages - The Need for Ventilators and Personal Protective Equipment during the Covid-19 Pandemic. N Engl J Med 2020;382(18):e41. Doi: 10.1056/NEJMp2006141
4 Joseph B, Joseph M. The health of the healthcare workers. Indian J Occup Environ Med 2016;20(02):71–72. Doi: 10.4103/0019-5278.197518
5 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(10270):220–232. Doi: 10.1016/S0140-6736(20)32656-8
6 Benedict C, Partinen M, Bjorvatn B, Cedernaes J. Sleep in Female Healthcare Workers during COVID-19: A Cross-Sectional Survey Study in Sweden during the Flattening of the First Wave of the Pandemic. Ann Am Thorac Soc 2021;18(08):1418–1420. Doi: 10.1513/AnnalsATS.202101-019RL
7 Bozan Ö, Atiş ŞE, Çekmen B, Şentürk M, Kalkan A. Healthcare workers' sleep quality after COVID-19 infection: A cross-sectional study. Int J Clin Pract 2021;75(11):e14772. Doi: 10.1111/ijcp.14772
8 Vitale JA, Perazzo P, Silingardi M, Biffi M, Banfi G, Negrini F. Is disruption of sleep quality a consequence of severe Covid-19 infection? A case-series examination. Chronobiol Int 2020;37(07):1110–1114. Doi: 10.1080/07420528.2020.1775241

9 Ahmed GK, Khedr EM, Hamad DA, Meshref TS, Hashem MM, Aly MM. Long term impact of Covid-19 infection on sleep and mental health: A cross-sectional study. Psychiatry Res 2021;305:114243. Doi: 10.1016/j.psychres.2021.114243
10 Maugeri G, Musumeci G. Adapted physical activity to ensure the physical and psychological well-being of COVID-19 patients. J Funct Morphol Kinesiol 2021;6(01):13. Doi: 10.3390/jfmk6010013
11 Castañeda-Babarro A, Arbillaga-Etxarri A, Gutiérrez-Santamaría B, Coca A. Physical activity change during COVID-19 confinement. Int J Environ Res Public Health 2020;17(18):6878. Doi: 10.3390/ijerph17186878
12 Li C, Xu BH. The viral, epidemiologic, clinical characteristics and potential therapy options for COVID-19: a review. Eur Rev Med Pharmacol Sci 2020;24(08):4576–4584. Doi: 10.26355/eurrev_202004_21044
13 Bertolazi AN, Fagondes SC, Hoff LS, Pedro VD, Menna Barreto SS, Johns MW. Validação da escala de sonolência de Epworth em português para uso no Brasil. J Bras Pneumol 2009;35(09): 877–883. Doi: 10.1590/S1806-37132009000900009
14 Bertolazi AN, Fagondes SC, Hoff LS, et al. Validation of the Brazilian Portuguese version of the Pittsburgh sleep quality index. Sleep Med 2011;12(01):70–75. Doi: 10.1016/j.sleep.2010.04.020
15 Matsudo S, Araújo T, Matsudo V, et al. International physical activity questionnaire (IPAQ): study of validity and reliability in Brazil. Rev Bras Ativ Fis Saúde. 2001;6(02):5–18
16 Tran TV, Nguyen HC, Pham LV, et al. Impacts and interactions of COVID-19 response involvement, health-related behaviours, health literacy on anxiety, depression and health-related quality of life among healthcare workers: a cross-sectional study. BMJ Open 2020;10(12):e041394. Doi: 10.1136/bmjopen- 2020-041394
17 Tanrıverdi A, Savci S, Kahraman BO, Ozpelit E. Comparison of muscle strength, physical activity, mood and sleep quality in patients with recovered from mild and moderate COVID-19. Eur Respiratory Soc. 2021;58(65):2268. Doi: 10.1183/13993003.congress-2021.PA2268
18 Aslan H, Tomczak C, Marciniuk D, Butcher S. Persistent dyspnea, declined moderate to vigorous physical activity, functional status, and quality of life during the post-acute phase of COVID-19 infection: A pilot case control study. NeuroSports 2021;1(01):10Available at . https://nsuworks.nova.edu/neurosports/vol1/iss1/10
19 Omar DI, Hassan OM, Hani BM. SLEEP QUALITY AND ITS DETERMINANTS AMONG NURSES DURING COVID-19 PANDEMIC. Egypt J Occup Med 2022;46(01):75–92. Doi: 10.21608/EJOM.2021.82911.1239
20 Semyachkina-Glushkovskaya O, Mamedova A, Vinnik V, et al. Brain mechanisms of COVID-19-sleep disorders. Int J Mol Sci 2021;22(13):6917. Doi: 10.3390/ijms22136917
21 Meira E Cruz M, Miyazawa M, Gozal D. Putative contributions of circadian clock and sleep in the context of SARS-CoV-2 infection. Eur Respir J 2020;55(06):2001023. Doi: 10.1183/13993003.01023-2020
22 Poyraz BÇ, Poyraz CA, Olğun Y, et al. Psychiatric morbidity and protracted symptoms in recovered COVID-19 patients. medRxiv 2020;10(07):20208249. Doi: 10.1101/2020.10.07.20208249
23 Herrero San Martin A, Parra Serrano J, Diaz Cambriles T, et al. Sleep characteristics in health workers exposed to the COVID-19 pandemic. Sleep Med 2020;75:388–394. Doi: 10.1016/j.sleep.2020.08.013

