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Original article

A survey assessing sleep efficiency among Saudis during COVID-19 home confinement using the Pittsburgh sleep quality index: A call for health education

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ABSTRACT

The COVID-19 pandemic has introduced uncertainties that have disrupted regular routines. Sleep may be adversely affected by stressful circumstances that jeopardize general health. Hence, the impact of home confinement on the sleep efficiency of the general population was assessed.

An online survey was conducted by using the Pittsburgh sleep quality index (PSQI) to assess sleep duration, sleep efficiency, latency to fall asleep, and global PSQI score. Questions pertaining to demography, home confinement, and anxiety were included. Data was collected from the residents of the Southwestern region from April 15, 2020 to May 15, 2020. Data were analyzed through bivariate, multivariate logistic regression, and independent t tests.

A total of 593 subjects responded to the survey. Males (OR 1.92 [1.3–2.7], $p < 0.001$), and subjects aged $\geq$51 years (OR 2.49 [1.3–4.4], $p = 0.002$) were more likely to be poor sleepers (<6 h). In hypertensive subjects, inadequate sleep was twice as high (OR 2.2 [1.1–4.4], $p < 0.05$) than other comorbidities. Males were less likely to have sleep latency (OR 0.58 [0.40–0.86], $p = 0.005$) but smoking increased the latency of falling asleep (OR 2.41 [1.47–4.0], $p < 0.001$). Sleep duration was significantly influenced by home confinement ($p = 0.002$), whereas sleep duration ($p = 0.001$), latency ($p = 0.018$), sleep efficiency ($p = 0.005$), and global PSQI scores ($p = 0.005$) were significantly affected by anxiety.

In the southwestern region, we found sleep influenced by anxiety about COVID-19. Community pharmacists are the most accessible health care professionals and could play a pivotal role in educating the lay public on the importance of sleep hygiene through posters displayed in pharmacies and with the help of public education material.

1. Introduction

COVID-19 affects not only the physical health of infected persons but also the psychological health and wellbeing of the non-infected population (Han et al., 2020). COVID-19 and the consequent lockout have changed schedules, caused the masses to operate temporarily from home for months, and forced everyone to stay indoors. Studies have indicated that the pandemic has influenced sleep patterns (Morin and Carrier 2020; Voitsidis et al., 2020), induced stress, and anxiety (Vinkers et al., 2020). About 30% of American adults have encountered sleeping problems; in addition, 68% of Americans struggle with sleep. A pre pandemic survey conducted on Saudi adults has found that 33.8% have a total sleep time of fewer than seven hours (Ahmed et al., 2017). Another study has shown that 41.5% of Saudi residents suffer from sleep deprivation. Besides, home confinement has reduced physical activity and daylight exposure, which are essential for good sleep. Engaging in satisfying activities is difficult because of social isolation. Sleep aids in the immune system's proper functioning, improves memory, promotes tissue repair, reduces blood pressure, and enhances cell regeneration. These changes disrupt nighttime sleep (Altena et al., 2020) and increase the risk of mental health problems (Leigh-Hunt et al., 2017). An appropriate amount of sleep

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prepares the body to resist injury and illness, decreases the risk of infection, and increases immunity against COVID-19. Conversely, sleep deprivation leads to various unhealthy effects, such as mood swings, difficulty dealing with change, loss of energy, high blood pressure, sleepiness, and a weakened immune system (Besedovsky et al., 2019).

However, good quality sleep depends on different determinants, such as sleeping for more time, falling asleep in 30 min or less, less awakening at night, and staying awake for 20 min or less before falling asleep. Poor sleep reflects waking up several times at night, experiencing symptoms of sleep disorders, and not feeling refreshed even after the night's sleep. Sleep quality is categorized as subjective and objective based on these determinants; that is, subjective sleep quality depends on the satisfaction of the overall sleep experience, and objective sleep quality relies on the total length and frequency of awakening during the night (O'Donnell et al., 2009).

In certain geographical regions, a higher prevalence of COVID-19 infections has led people to feel nervous, afraid, and worried. Even in areas where the infection is well controlled, sleep quality can be compromised by changes in daily activities because of the mandated lockdown. Given that the pandemic is not short-lived, and its result may affect the public for a prolonged period, the psycho-physiological wellbeing of the population should be tracked. Moreover, the unprecedented risk of morbidities and mortality could trigger psychological distress. Alkhamees et al. have reported moderate or severe psychological distress due to COVID-19 among one-fourth of the Saudi residents with almost an equal proportion experiencing anxiety and depression (Alkhamees et al., 2020). Related research should be conducted to develop evidence-driven policies, encourage decision-making, promote public awareness, and provide timely and supportive psychosocial interventions (American Academy of Pediatrics. Section on Pediatric Pulmonology and Sleep Medicine 2018). Therefore, the current study was conducted to evaluate the effect of COVID-19 on the sleep efficiency of people living in the southwestern region of Saudi Arabia by using the Pittsburgh sleep quality index (PSQI) (Buysse et al., 1989).

2. Methods

A cross-sectional online survey was conducted to assess sleep performance in the general population residing in Southwestern Saudi Arabia. Data collection was done during home confinement because of the COVID-19 pandemic. The first lockdown was announced on March 16 and subsequently extended up to the end of June. Hence, the survey was initiated from April 15, 2020, to May 15, 2020, when the lockdown was mandated.

The study was approved by the Institutional Research Review & Ethics Committee (IRREC) of Faculty of Pharmacy, Jazan University bearing number 203/2008/1441 dated 20–08-1441.

The southwestern part of Saudi Arabia is a coastal region with a total population of 1,993,457. Therefore, the sample size was 664 with a 99% confidence interval, 5% error margin, 35% expected proportion, and 10% attrition rate.

The PSQI questionnaire was translated into Arabic by a native speaker who has command over both languages and made available in English. The transcript was then translated back to English to decide if the content was meaningful. For the user's convenience, a Google form was then created containing questions in both languages. A brief introduction to the purpose of the survey was supplied with the link to the questionnaire. Confidentiality and anonymity were guaranteed, but participation was voluntary.

Due to home confinement, snowball sampling was adopted. Several strategies were adopted to circulate the questionnaire. The link to the survey was sent through virtual networks to reach the residents in the region. After three days, a reminder was sent to ask the participants to respond to the questionnaire or ignore if they had already replied. The research included participants above the age of 18 years.

The PSQI was used to evaluate sleep disturbances in the general population in Southwestern Saudi Arabia. It is a popular validated instrument developed to assess sleep efficiency and duration. The PSQI questionnaire had nine questions converted into seven components, with each element given a score between 0 and 3. The first to seven components were as follows: C1, subjective sleep quality; C2, sleep latency; C3, sleep duration; C4, habitual sleep efficiency; C5, sleep disturbance; C6, sleep medication use; and C7, daytime dysfunction. The seven components were added to determine the global score, which ranged from 0 to 21. A high score reflected the magnitude of disturbed sleep (Buysse et al. 1989). A PSQI total score at five or more indicated low sleep quality with a diagnostic sensitivity of 90% and a specificity of 67%. Apart from the PSQI, the questionnaire included questions on sociodemographic factors, their response to home confinement, and stress associated with COVID-19.

2.1. Statistical analysis

Data were entered into Excel and analyzed with SPSS version 23.0. (IBM, Armonk, New York). Categorical variables were represented as frequency and percentage. The global PSQI score, sleep duration, and time-lapse in sleep onset were presented as mean with their standard deviation (SD). Sleep duration was dichotomized into two groups: good sleep (>6 h) and poor sleep ($\leq$6 h). Latency to fall asleep was dichotomized into two groups: >30 min and $\leq$30 min. The predictors of poor sleep were identified through the Pearson Chi-square test and multivariate logistic regression. An independent *t*-test was run to determine the difference in PSQI scores and subscores of the seven components in home-confined individuals and due to anxiety ensuing due to COVID-19. Statistical tests were two sided, and data with $p \leq 0.05$ were considered significant.

3. Results

A total of 593 participants responded to the survey from the expected count of 664, giving a response rate of 89.30%. Of the respondents, 57.7% were males, and 42.3% were females. The response from the age group of 20–30 years was 38.6%, 30.4% were between 31 and 40 years, 17% were in the age group of 41–50 years, and 14% were $\geq$51 years. Most of the respondents were from Jazan (43.8%), 33.4% were from Najran, and 22.8% were from Aseer. Of the respondents, 83.6% did not smoke, 16.4% had primary education, 31.7% had high school education, 34.4% were graduates, and 17.5% were postgraduates and higher. Furthermore, 61.6% were comorbidity-free, 5.2% were asthma affected, 3% had diabetes, 9.3% had hypertension, 17.4% had allergic reactions, and 3.5% had epilepsy. Most of the respondents did not have a family history of psychiatric disorders and were not on sedatives. The respondents felt that home confinement affected their sleep, and 70.2% were worried about the infection (Table 1).

Gender differences existed. The PSQI score (7.2) of the female respondents was higher than that of the males. The mean latency to fall asleep of the former was 42.51 (SD 31.6) min, which was longer than that of the latter. Although the mean PSQI score and the sleep latency of the age group $\geq$51 years were high, the mean sleep duration was the shortest. The latency to fall asleep in the age groups of 41–50 years was higher, i.e., 45.13 (SD 34.3) min. The PSQI score differed regionally. The respondents from Asser had a

Table 1
Sociodemograpic information and sleep parameters.

Characteristics	Overall total (%) (N = 593)	PQSI score, Mean (SD)	Sleep duration (hours) Mean (SD)	Sleep latency (min) Mean (SD)
Gender				
Male	342 (57.7)	6.91 (2.9)	6.74 (1.9)	39.20 (32.7)
Female	251 (42.3)	7.2 (3.2)	6.17 (2.0)	42.51 (31.6)
Age (Years)				
20–30	229 (38.6)	6.94 (3.0)	6.4 (2.0)	41.41 (32.3)
31–40	180 (30.4)	6.91 (2.7)	6.17 (1.9)	36.06 (31.4)
41–50	101 (17.0)	6.97 (3.3)	7.03 (2.0)	45.13 (34.3)
51 and above	83 (14.0)	7.61 (3.3)	6.13 (2.1)	42.71 (30.7)
Region				
Jazan	260 (43.8)	6.90 (3.1)	6.38 (2.0)	40.36 (31.3)
Najran	198 (33.4)	7.09 (2.1)	6.32 (1.9)	39.43 (39.1)
Asser	135 (22.8)	7.14 (3.2)	6.61 (2.0)	42.77 (35.7)
Education				
Primary education	97 (16.4)	6.0 (2.7)	6.69 (2.3)	35.53 (34.8)
High school	188 (31.7)	6.85 (3.0)	6.44 (1.8)	39.06 (30.8)
Graduate	204 (34.4)	7.47 (3.0)	6.18 (2.0)	43.42 (30.8)
Post-graduate & higher	104 (17.5)	7.46 (3.2)	6.5 (2.1)	42.5 (34.8)
Comorbidities				
Asthma	31 (5.2)	7.74 (4)	6.8 (2.3)	55.61 (36.01)
Diabetes	18 (3.0)	6.72 (2.2)	7.0 (1.9)	43.38 (29.81)
Hypertension	55 (9.3)	8.09 (3.4)	5.4 (1.7)	33.63 (28.2)
Allergic	103 (17.4)	6.28 (2.9)	6.4 (1.9)	31.73 (30.15)
Epilepsy	21 (3.5)	7.38 (2.3)	6.0 (1.8)	32.28 (23)
None	365 (61.6)	7.05 (3)	6.5 (2.0)	43.22 (32.9)
Family history of psychiatric disorders				
Yes	87 (14.7)	7.54 (2.7)	6.7 (2.1)	49.7 (35.6)
No	506 (85.3)	6.94 (3.1)	6.3 (2.1)	39.04 (31.4)
Have you been taking sleeping pills				
Yes	50 (8.4)	8.29 (2.7)	7.12 (1.8)	41.1 (29.9)
No	543 (91.6)	6.9 (3)	6.3 (2.0)	40.55 (32.5)
Smoking				
Yes	97 (16.4)	7.68 (2.7)	6.34 (2.0)	51.14 (35.7)
No	496 (83.6)	6.94 (3.1)	6.4 (2.0)	38.54 (31.9)
Affected by home confinement				
Yes	489 (82.5)	7.11 (3.1)	6.28 (2.0)	40.28 (32)
No	104 (17.5)	6.66 (3.0)	7.0 (2.1)	42.09 (33.4)
Are you worried/anxious of the infection				
Yes	416 (70.2)	7.26 (3.0)	6.18 (1.9)	37.35 (34.4)
No	177 (29.8)	6.48 (3.0)	6.97 (2.2)	41.91 (31.29)

high PSQI score of 7.14 and latency to fall asleep of 42.77 (SD 35.7) min. The subjects with a smoking habit had a mean PSQI score of 7.68 and latency to fall asleep of 51.14 (35.7) min. The PSQI score and the latency to fall asleep of graduates and postgraduates were higher than those of the respondents with primary and high school education. The respondents with hypertension had the highest PSQI score of 8.09, followed by the subjects with asthma (7.74). However, the sleep duration of the subjects with hypertension was short. The subjects with asthma had the highest latency to fall asleep (55.61 SD 36.01 min) among the individuals with other comorbidities. Individuals with a family history of psychiatric disorders and sleeping pills had higher PSQI scores (Table 1).

Table 2 reflects the relationship between poor sleepers and demographic variables. A statistically significant association between gender and sleep duration (good/poor) was observed (χ^2 = 10.22 [1], p = 0.001). Age was significantly associated with the disparity in sleep duration (χ^2 = 11.44 [3], p = 0.01). No differences in sleep duration were found between the different regions. Education significantly affected sleep duration (χ^2 = 20.32 [3], p = 0.001). The presence of comorbidities was related to sleep duration (χ^2 = 12.13 [5], p = 0.03). Sleep duration affected males more than females (OR 1.92 [1.3–2.7], p = 0.001) and subjects aged $\geq$51 years (OR 2.49 [1.3–4.4], p = 0.002). It also less affected the respondents with primary education (OR 0.46 [0.25–0.83], p = 0.01) and significantly affected individuals with hypertension (OR 2.2 [1.1–4.4], p = 0.02; Table 2).

Table 3 shows the relationship between the latency to fall asleep and demographic variables. Gender (χ^2 = 4.9 [1], p = 0.03), age (χ^2 = 9.35 [3], p = 0.02), education (χ^2 = 12.91 [3], p = 0.005), comorbidities (χ^2 = 15.79 [5], p = 0.007), and smoking (χ^2 = 10.22 [1], p = 0.001) were significantly associated with the latency to fall asleep.

After adjustments were made for age in multiple logistic regression, males were significantly less likely to have latency in the onset of sleep than females (OR 0.58 [0.40–0.86], p = 0.005). The sleep onset of individuals with primary education (OR 0.50 [0.27–0.93], p = 0.02) and subjects with allergies (OR 0.46 [0.28–0.75], p = 0.002) was less likely affected, whereas their sleep onset was more likely to be affected by smoking (OR 2.41 [1.47–4.0], p = 0.001; Table 3).

Table 4 presents the mean differences between the seven components of the PSQI and stress associated with COVID-19. Home confinement significantly affected sleep duration (t = −3.05 [591], p = 0.002). However, significant variations in the other components were not observed. Conversely, being worried/anxious of the infection significantly affected sleep latency (t = −2.3 [591], p = 0.018), sleep duration (t = −4.5 [591], p = 0.001), sleep efficiency (t = −2.7 [1.0], p = 0.005), and PSQI score (t = −2.84 [591], p = 0.005; Table 4).

4. Discussion

The study documented the influence of COVID-19 on the quality of sleep among the residents of Southwestern Saudi Arabia. Sleep is essential to preserve health. Inadequate sleep leads to heart dis-

Table 2
Bivariate and multivariate analyses of sleep duration with demograpic variables.

Sleep duration (poor/good)						
Covariates	Sleep duration (h)		Bivariate		Multivariate	
	>6	≤6	χ^2	p-value	AOR [95% CI]	p-value
Gender	N (%)		10.22 (1)	0.001*		
Male	132 (38.6)	210 (61.4)			1.92 [1.3–2.7]	0.001*
Female	130 (51.8)	121 (48.2)			1 [Reference]	
Age (Years)			11.44 (3)	0.01*		
20–30	115 (50.2)	114 (49.8)			1 [Reference]	
31–40	77 (42.8)	103 (57.2)			1.29 [0.85–1.9]	0.22
41–50	46 (45.5)	55 (54.5)			1.25 [1.76–2.06]	0.36
>50	24 (28.9)	59 (71.1)			2.49 [1.3–4.4]	0.002*
Region			2.7 (2)	0.26		
Jazan	110 (42.3)	150 (57.7)			–	–
Najran	82 (42.4)	114 (57.6)				
Asser	68 (50.4)	67 (49.6)				
Education			20.32 (3)	0.001*		
Primary	59 (60.8)	38 (39.2)			0.46 [0.25–0.83]	0.01*
High school	90 (47.9)	98 (52.1)			0.73 [0.44–1.2]	0.23
Graduate	70 (34.3)	134 (65.7)			1.3 [0.80–2.2]	0.26
Post-graduate	43 (41.3)	61 (58.7)			1 [Reference]	
Comorbidities			12.13 (5)	0.032*		
Asthma	17 (54.8)	14 (45.2)			0.61 [0.28–1.3]	0.22
Diabetes	9 (50)	9 (50)			0.47 [0.17–1.2]	0.13
Hypertension	13 (23.9)	42 (76.4)			2.2 [1.1–4.4]	0.022*
Allergic	49 (47.6)	54 (52.4)			0.95 [0.60–1.5]	0.84
Epilepsy	8 (38.1)	13 (61.9)			1.5 [0.59–4.1]	0.36
None	166 (45.5)	199 (54.5)			1 [Reference]	
Family history of psychiatric disorders			0.35 (1)	0.56	–	–
Yes	41 (47.1)	46 (52.9)				
No	221 (43.7)	285 (56.3)				
Have you been taking sleeping pills			4.22 (1)	0.052	–	–
Yes	29 (58)	21 (42)			0.60 [0.32–1.1]	0.11
No	233 (42.9)	310 (57.1)			1 [Reference]	
Smoking			0.03 (1)	0.91	–	–
Yes	42 (43.3)	55 (56.7)				
No	220 (44.4)	276 (55.6)				

* P < 0.05 indicated statistically significant differences.

ease, diabetes, depression, and decreased immunity, preparing the body to become susceptible to pathogens, decreasing occupational productivity, and significantly influencing the quality of life. Sleep quality and sleepiness are clinically crucial during the daytime and are used to measure sleep-wake function. PSQI is a valuable instrument used to measure the consistency and pattern of sleep during home confinement and differentiate "poor" sleep from "good" sleep by measuring seven domains. The scoring of the response was based on a 0–3 scale, where 3 on the Likert scale corresponded to a negatively extreme response. A global sum of "5" or higher score was representative of "poor" sleep (Daniel et al., 2008).

The southwest region of Saudi Arabia has three central areas: Jazan, Asser, and Najran. More responses were collected from Jazan (N = 260) than from Najran (N = 198) and Asser (N = 135), possibly because Jazan is the region's cultural and business center and more advanced than the border region (Najran) and the hilly region (Asser). Jazan has oil refineries and is an industrial town, so it is more populated.

Responses were obtained from participants of various ages; however, ≥51 years had a higher PSQI score of 7.61 years but had a lower number (14%). Young people aged 30 years were interested in giving their reviews and accounted for 38.6%. The younger age group was technologically more equipped than, the older age group, plausibly leading to a higher response.

Sleep duration of ≤6 h in 24 h was classified as poor sleep, whereas >6 h of sleep in 24 h was considered good sleep. Age influenced sleep quality and duration. The age group of 31–40 years was 1.3 times more likely to experience poor sleep, and the age group of 41–50 years was 1.25 times more likely to experience poor sleep. Furthermore, individuals aged 51 years and older were two and half times more likely to be poor sleepers. Comorbidities and family stress are correlated with age (Neikrug and Ancoli-Israel 2010), affecting sleep duration in individuals in the age group of ≥51 years. However, the pandemic induced anxiety in all the other groups resulting in a decline in sleep duration (Otu et al., 2020). Our results indicated that women were taking more time to fall asleep than men plausibly because of their heightened anxiety about exposure to potential stress (Mohit Varshney 2020; Özdin and Bayrak Özdin 2020).

The educational level affected our survey. The number of participants with primary education (16.4%) was the lowest, followed by the number of individuals with high school education (31.7%), whereas the number of participants with graduate education was the highest (34.4%). For people with a lower education level, the use of electronic surveys to provide input could trigger difficulties. Individuals with a lower education level were one-half times less likely to have a short sleep duration. However, substantial sleep latency and higher global PSQI scores were observed in individuals with a graduate degree. The postgraduates had a PSQI score of 7.46, which was similar to the graduates' score (7.47). The graduates were 1.3 times more likely to have shorter sleep duration. Sleep disturbances, anxiety, and depression have been recorded in many studies during the pandemic (Stickley et al., 2019; Otu et al., 2020).

The homeostatic and circadian systems govern sleep (Deboer 2018). The homeostatic system is an internal factor, which is a function between the amount of sleep and the requirement of sleep. However, the circadian system is an external factor, the 24 h clock, and the daylight–nighttime cycle. Transferring jobs from an office environment to a home environment during COVID-19 has made people less physically active, which may have

Table 3
Predictors of sleep latency in the general population.

Covariates	Latency in onset of sleep (min)					
	Sleep latency		Bivariate		Multivariate	
	> 30min	≤ 30 min	χ^2	p-value	AOR [95 %CI]	p-value
Gender			4.9 (1)	0.030		
Male	142 (41.8)	198 (58.2)			0.58 [0.40–0.86]	0.005*
Female	128 (51)	123 (49)			1 [Reference]	
Age (Years)			9.35 (3)	0.025*		
20–30	109 (47.6)	120 (52.4)			1 [Reference]	
31–40	66 (36.7)	114 (63.3)			0.66 [0.43–1.03]	0.07
41–50	52 (51.5)	47 (46.5)			1.25 [0.76–2.05]	0.37
≥51	43 (51.8)	40 (448.2)			1.27 [0.73–2.2]	0.38
Region			0.18 (2)	0.92		
Jazan	120 (46.3)	139 (53.7)			–	–
Najran	88 (44.4)	110 (55.6)				
Asser	62 (46.3)	72 (53.7)				
Education			12.91 (3)	0.005*		
Primary	33 (34)	64 (66)			0.50 [0.27–0.93]	0.02*
High school	78 (41.5)	110 (58.5)			0.73 [0.44–1.2]	0.24
Graduate	111 (54.4)	93 (45.6)			1.26 [0.76–2.08]	0.35
Post-graduate	48 (47.2)	5 (52.9)			1 [Reference]	
Comorbidities			15.79 (5)	0.007*		
Asthma	20 (64.5)	11 (35.5)			1.80 [0.83–4.1]	0.12
Diabetes	9 (52.9)	8 (47.1)			1.02 [0.36–2.8]	0.96
Hypertension	22 (40)	33 (66)			0.57 [0.30–1.05]	0.07
Allergic	32 (31.1)	71 (68.9)			0.46 [0.28–0.75]	0.002*
Epilepsy	11 (52.4)	10 947.6)			0.92 [0.36–2.3]	0.87
None	176 (48.4)	188 (51.6)			1 [Reference]	
Family history of psychiatric disorders			5.71 (1)	0.020*		
Yes	50 (57.5)	37 (42.5)			1.5 [0.91–2.4]	0.11
No	220 (43.7)	284 (56.3)			1 [Reference]	
Have you been taking sleeping pills			0.11 (1)	0.76	–	–
Yes	24 (48)	26 (52)				
No	246 (45.5)	295 (54.5)				
Smoking			7.99 (1)	0.005*		
Yes	57 (58.8)	40 (41.2)			2.41 [1.47–4.0]	0.001*
No	213 (43.1)	281 (56.9)			1 [Reference]	

* P < 0.05 indicated statistically significant differences.

Table 4
Relationship between COVID-19-related factors and sleep parametes.

Variable	PQSI component scores [Mean (SD)]							
	Subjective sleep quality	Sleep latency	Sleep duration	Sleep efficiency	Sleep disturbance	Use of sleep medication	Daytime dysfunction	PQSI score
Affected with home confinement								
Yes	0.94 (0.77)	1.61 (0.93)	1.49 (1.0)	0.28 (0.05)	1.12 (0.49)	0.29 (0.70)	1.34 (0.97)	7.11 (3.1)
No	0.94 (0.88)	1.66 (0.94)	1.14 (1.0)	0.24 (0.49)	1.05 (0.49)	0.26 (0.69)	1.35 (1.0)	6.6 (3.0)
t (df)	−0.14 (591)	0.45 (591)	−3.05 (591)	−0.67 (591)	−1.32 (591)	−0.35 (591)	0.11 (591)	−1.3 (591)
p-value	0.88	0.65	0.002*	0.50	0.18	0.72	0.90	0.18
Worried/anxious of infection								
Yes	0.95 (0.78)	1.68 (0.94)	1.56 (1.04)	0.31 (0.56)	1.12(0.50)	0.26 (0.66)	1.34 (0.97)	7.2 (3.0)
No	0.90 (0.80)	1.49 (0.89)	1.13 (1.12)	0.18 (0.38)	1.09 (0.48)	0.34 (0.79)	1.33 (1.0)	6.48 (3.0)
t (df)	−0.77 (591)	−2.3 (591)	−4.5 (591)	−2.7 (591)	−0.64 (591)	1.19 (591)	−0.108 (591)	−2.84 (591)
p-value	0.43	0.018*	0.001*	0.005*	0.51	0.23	0.91	0.005*

* P < 0.05 indicated statistically significant differences.

disrupted their homeostatic system. Similarly, less exposure to outdoor light might have created imbalances in their circadian system. As a result, eating habits and eating time might have changed, affecting their sleep quantity and quality. These changes were apparent during the COVID-19 home confinement period.

Comorbidities should be understood to assess sleep quality, sleep onset, and duration. This study found 38.4% of the participants suffered from different ailments, and the global PSQI score of the participants afflicted with comorbidities was above 5. Furthermore, 9.3% and 3.5% of the respondents were afflicted with hypertension and epilepsy, respectively. The highest PSQI score was observed in individuals with hypertension, followed by the subjects afflicted with asthma and epilepsy. Patients with hypertension were twice more likely to be poor sleepers and had a high global PSQI score of 8.09. Several reports have stated the relationship between poor sleep and hypertension, thereby corroborating our finding. In one study, 42% of patients with hypertension were poor sleepers (Alebiosu et al., 2009). Studies have found high global PSQI scores among individuals with hypertension (Liu et al., 2016; Kenneth et al., 2018). Besides, hypertension may cause discomfort at night because of anxiety, restlessness, and insomnia (Aggarwal et al., 2018). Moreover, hypertension leading to sleep disturbances and vice versa is a vicious cycle that may accelerate cardiovascular disorders.

Epilepsy was observed to be a predictor of poor sleep. Individuals with epilepsy were one and a half time more likely to be poor sleepers. Studies have reported the association between epilepsy and low sleep quality (Staniszewska et al., 2017).

Among the respondents, 5.2% were stricken with asthma and might experience some troublesome nights throughout the year. The quality of sleep of these respondents was affected, as they took more time to fall asleep. Furthermore, subjects with asthma and related respiratory problems experience poor sleep quality (Cukic et al., 2011).

Most of the respondents were devoid of any comorbidities but surprisingly had sleep disturbances, and their mean PSQI score was 7.05. Despite being healthy, they experienced sleep disturbances, which were plausibly circumstantial and related to the pandemic. Our findings also agreed with many researchers in the field (Han et al. 2020; Sher 2020; Zambrelli et al., 2020).

Among the study population, 4.7% of the respondents had psychiatric disorders. These respondents experienced significant disturbances in sleep duration and sleep latency. Diminished sleep was also observed in subjects taking sleeping pills as they had a global PSQI score of 8.29. However, no significant association was observed between sleeping pills, sleep duration, and latency to fall asleep in the study population.

Smokers constituted 16.4% of the study population and demonstrated a higher PSQI score, indicating a low overall sleep quality. They were 2.4 times more likely to delay initiating sleep and took an average of 51 min to fall asleep. Nicotine present in cigarettes could contribute to these disturbances, as it can cause an imbalance in the levels of neurotransmitters altering sleep (Zhang et al., 2006). Although the quality of sleep was affected, no association was observed between smoking and sleep quantity.

Each of the seven components of PSQI was categorized into four grades to understand them better as "0," representing very good and "3" as very bad. No difference in six of the seven components of the PSQI and the global PSQI score was detected among home-confined individuals but was significantly different in sleep duration ($p < 0.002$). However, a significant difference was found between anxiety versus none about COVID-19 and sleep latency ($p < 0.018$), sleep duration ($p < 0.001$), sleep efficiency ($p < 0.005$), and global PSQI scores ($p < 0.005$). This result indicated that COVID-19 affected the general population, causing fear and worries related to self-health and family health. Furthermore, sleep habits could be strongly affected by the lack of social contacts, changed work schedules, and the lack of social activities (Brooks et al., 2020). Moreover, home confinement significantly influenced sleep duration.

Sleep dysfunction can be a significant contributor to various disorders, and community pharmacists being the most accessible health care professional, could deliver educational interventions, especially during a health crisis. Display of posters and public education material in pharmacies on sleep hygiene can serve as an educational tool to customers visiting the pharmacy. Fuller et al. have reported that pharmacist practitioners could motivate patients to bring about lifestyle changes and improve sleep hygiene (Fuller et al., 2011). Noor et al. have identified that community pharmacists could deliver the intervention to monitor sleep behavior along with actigraphic evaluation (Mohamad Noor et al., 2014).

Moreover, as sleep disturbances can trigger several health complications and could be an invisible burden to society; hence, we plan to provide pharmacists with didactic lectures on sleep hygiene and its importance as they are the first to be approached for sleep aids. As we observed a generalized change in sleep pattern, our focus in the future would be on specific populations and measure this using the actigraph to obtain more objective information.

We acknowledge the presence of limitations in our study. First, it would be ideal to use enumerators to collect data in such surveys to avoid confusion in recording bedtime despite having the questionnaire written in the native language. However, the best approach was adopted because of the current circumstances. Second, the retrospective appraisal of their sleep duration, latency, and daytime disturbances might induce a risk of recall bias and lead to underestimating or overestimating sleep parameters. Third, assessing sleep quality before the onset of the pandemic would have contributed to the relative comparison of data. Lastly, we evaluated subjective sleep quality, but if substantiated with objective sleep quality assessment, the generalizability could be far superior. However, given the virus's infectious nature, disturbing schedules, altered physical activity, and social isolation, this study collected the most relevant data on the population's sleep quality and quantity during the pandemic. Fourthly, the use of snowball sampling might not provide an accurate representation of the population.

In conclusion, the sleep duration, latency to fall asleep, and global PSQI scores of the general population were affected. Although sleep deficits are a significant problem worldwide, the pandemic has further caused a detrimental effect on sleep components. Sleep is necessary to maintain good health. As stress associated with the pandemic can linger, community pharmacists can create sleep health awareness to minimize the risk of morbidities related to poor sleep.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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