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Predictors of Sleep Quality Among Type 2 Diabetes Mellitus Patients

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Abstract: *One of the health problems experienced by patients with type 2 diabetes mellitus is poor sleep quality. Poor sleep quality is an important factor in poor blood sugar regulation. This study aims to determine the predictors of sleep quality in patients with type 2 diabetes mellitus at a private hospital in Yogyakarta. This research used a cross-sectional approach on 150 type 2 diabetes mellitus patients recruited at the Endocrine Clinic at a private hospital in Yogyakarta. The questionnaires used in this research were demographic data questionnaires, the Perceived Stress Scale (PSS-10), and the Pittsburgh Sleep Quality Index (PSQI). Data analysis was carried out using Multiple hierarchical linear regression. The research results show that the average stress score of respondents in this study was 16.13 (SD = 4.59), which is in the medium category. Global PSQI showed respondents experienced poor sleep quality (mean = 5.33, SD = 1.79). The Perceived Stress Scale score contributed 23.6% to the sleep quality score. The higher the respondent's stress level, the lower the respondent's sleep quality. Nurses can develop interventions to improve the sleep quality of type 2 diabetes mellitus patients.*

Keywords: Perceived Stress Scale, Sleep Quality, Type 2 Diabetes Mellitus.

INTRODUCTION

Type 2 Diabetes Mellitus (T2DM) is a metabolic disease categorized by persistently raised blood glucose (Westman, 2021). The prevalence of DM is estimated to increase to 643 million in 2023. The International Diabetes Federation also reported that the number of people with diabetes in Indonesia is around 19,5 million (IDF, 2021). In Yogyakarta, the number of diabetes mellitus people is ranked in the top 3 in Indonesia.

Quality sleep is essential for patients with chronic conditions such as diabetes mellitus. However, 53.4% of diabetes patients experience poor sleep quality compared to 29% in the general population (Mohammed et al., 2017). Patients with type 2 diabetes mellitus are reported to suffer from higher levels of daily sleepiness and obstructive sleep apnea which has many adverse consequences (Lou et al., 2014, Osonoi et al., 2015).

Various factors have contributed to DM-related sleep problems. Those contributing factors include obesity and overweight, respiratory issues linked to sleep such as obstructive sleep apnea, poor bladder and bowel control caused by autonomic neuropathy, pain, and discomfort caused by diabetic neuropathy, nocturnal polyuria due to hyperglycemia (Arora et al., 2016; Fontela & Berlezi, 2015). Other conditions, such as stress also strongly associated with sleep problems (Merrill, 2022).

Studies showed that poor sleep quality is a significant factor in poor blood sugar regulation (Yunzhao et al., 2014). The previous study also confirmed that poor sleep quality was statistically correlated with poor glycemic control (Shibabaw, Dejenie, & Tesfa, 2023). Other research suggests poor sleep quality can cause complications, such as cardiovascular disease (Osonoi et al., 2015).
Since the prevalence of type 2 diabetes is increasing in Indonesia, as well as the importance of optimal glucose levels in diabetics, it is recommended to pay attention to the sleep quality and psychological state (stress) for optimal prevention and treatment of diabetic patients. Therefore, this cross-sectional study evaluated the predictor of sleep quality in patients with type 2 diabetes in Yogyakarta, Indonesia.

METHODS

This research is a quantitative study with a cross-sectional approach to analyze predictors of sleep quality in 150 patients with type 2 diabetes mellitus at a private hospital in Yogyakarta. The respondents were recruited with purposive sampling. The sample size was estimated by G-Power Software Version 3.1.9.7 using the F test assuming α error probability = .05 and power level = 0.80 (Kang, 2021). Because previous research did not reveal the effect size, in this study, the researcher used an effect size = 0.15 (medium effect size) (Schäfer & Schwarz, 2019), and considered 11 predictors (age, gender, education level, occupation, coffee consumption, BMI, physical activity, duration of DM, complications of DM, management of DM, perceived stress).

The sample in this study were patients with T2DM who visited the Internal Medicine Department. The inclusion criteria of the respondents were age > 18 years, understanding and could communicate in Bahasa Indonesia, willing to participate in the study. The patients who had a psychosis history were excluded from the study.

This research used 3 questionnaires: a demographic data questionnaire, the Indonesian version of the Pittsburgh Sleep Quality Index (PSQI) questionnaire, and the Indonesian version of the Perceived Stress Scale-10 (PSS-10). The PSQI and PSS-10 were used as this study's instruments because they have been validated and widely used in research and clinical practice.

Sleep quality was evaluated by the Pittsburgh Sleep Quality Index (PSQI). PSQI is a 19 self-rated items questionnaire measuring respondents' sleep status over the previous month. The seven subscales of the PSQI are subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medications, and daytime dysfunction. Each subscale had a score between 0 and 3. The global PSQI score ranges from 0 to 21. The higher global score of PSQI indicates poorer sleep quality (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989).

Perceived Stress Scale – 10 (PSS–10) is a scale to assess the perceived stress among respondents. PSS-10 is a tool for measuring psychological stress. This self-reported questionnaire measures "the degree to which individuals evaluate situations in their lives are appraised as stressful. The scale has 10 questions with answer options ranging from zero to four (0=never; 1=almost never; 2=sometimes; 3=almost always; 4=always). The overall score of the scale is the sum of the scores of these 10 questions. The scores range from zero to forty, higher scores correspond to a greater perception of stress (Cohen, 1988).

This study obtained an ethical statement from the Health Research Ethics Committee Panti Rapih Hospital (approval number No. 036/SKEPK-KKE/VII/2020)

RESULTS

The characteristics of the respondents in this study are presented in Table 1. More than half of the total respondents were female (n = 81; 54%), had a high school education or less (n = 89; 59.3%), and an average age of 59 years (mean = 69.25; SD = 10.21). The majority of respondents were unemployed (n = 113,75.3%). Around 68.7% of the respondents had routine physical activity (n = 103) and did not consume coffee (n = 100, 66.7%). The overall average BMI of respondents is in the overweight category (mean = 26.24; SD = 5.37). The duration of suffering from type 2 DM for respondents in this study was an average of 10 years (mean = 10.2, SD = 7.28). More than half of the respondents took anti-hyperglycemia medication to control blood sugar levels (n = 84, 56%). On average, respondents had at least 1 DM complication (mean = 1.06; SD = 0.90)

Table 1. Characteristic of The Respondents

Variables	Category	n	Percentage (%)
Gender	Male	69	46
	Female	81	54
Education	High school below	89	59.3
	College above	61	40.7
Employment	Unemployed	113	75.3
	Employed	37	24.7
Physical activity	No	47	31.3
	Yes	103	68.7
Coffee consumption	No	100	66.7
	Yes	50	33.3
DM Treatment	Oral medication	84	56
	Insulin	36	24
	Oral medication and insulin	28	18.7
	Diet	2	1.3
Variable	Mean (SD)	Minimum	Maximum
Age (year)	59,25 (10.21)	18	87
Number of complication	1.06 (0.90)	0	4
BMI	26.25 (5.37)	1763	67.43
DM duration	10.2 (7.28)	1	34

Perceived Stress

Table 2. Perceived Stress of The Respondents.

N=150

Variable	Mean (SD)	Minimum	Maximum
Perceived Stress	16,13 (4.59)	5	36

The PSS-10 score ranges between 0-40 with low-stress categories 0-13, moderate stress 14-26, and high stress 27-40. The average stress score of respondents in this study was 16.13 (4.59), which is in the medium category (Table 2)

Sleep Quality

The subscales of the PSQI are presented in Table 3. The subjective sleep quality subscale was calculated based on question item number 6 (mean = 0.91; SD = 0.60). The sleep latency subscale is the period of time it takes for respondents to fall asleep. The average time respondents fall asleep is 16-30 minutes (mean = 1.23, SD = 0.96). The sleep duration subscale is calculated based on item number 4. The sleep duration subscale describes the length of time or duration of the respondent's sleep. Respondents' average sleep duration is 6-7 hours per day. The habitual sleep subscale is calculated based on the time the respondent spends in bed and the respondent's actual sleep time. The average habitual efficiency component was 0.03 (SD = 0.21). The sleep disturbance subscale describes how often the respondent has sleep problems or disturbances. The sleep disturbance subscale is calculated by adding the scores for questions 5b-5j and categorized based on the total score. This study's average sleep disturbance subscale was 1.26 (SD = 0.48). From the results of this calculation, it can be interpreted that the respondent had 1 sleep disturbance in one month. The subscale of sleep medication is how often the respondent uses medication to help the respondent fall asleep. The average of this subscale shows that only a few respondents used medication to help sleep with a frequency of less than once a week in the past month (mean 0.16, SD = 0.49). The daytime dysfunction subscale describes activity disruptions experienced by respondents due to poor sleep quality. The average number of respondents who experienced activity was a mean of 0.69 (SD = 0.80). The results of the Global PSQI measurement show that respondents experienced poor sleep quality (mean = 5.33, SD = 1.79).

Table 3. Component of PSQI

N=150

No	PSQI Components	Mean (SD)	Minimal	Maksimal
1	*Subjective Sleep Quality*	0.91 (0.60)	0	2
2	*Sleep Latency*	1.23 (0.96)	0	3
3	*Sleep Duration*	0.97 (0.76)	0	3
4	*Habitual Sleep Efficiency*	0.03 (0.21)	0	2
5	*Sleep Disturbance*	1.26 (0.48)	0	2
6	*Using Sleep Medication*	0.16 (0.49)	0	3
7	*Daytime Disfunction*	0.69 (0.80)	0	3
	Global PSQI	5.33 (1.79)	2	11

Data analysis used two-step multiple hierarchical linear regression to find out which variables were predictors of sleep quality in this study population. Demographic data included in the analysis are gender, age, education, and occupation. In the first model, only demographic data, including gender, age, education, and occupation, were included in the analysis. There is a significant correlation between education and sleep quality (R2 = .064). The detailed results of the data analysis are in Table 4, which describes the predictor of sleep quality.

Table 4. Predictor of Sleep Quality

N=150

Variables	Model 1			Model 2		
	B	*β*	*VIF*	*B*	*β*	*VIF*
Intercept	6.76			4.62		
Gender	0.26	0.75	1.35	0.11	0.03	1.49
Age	-0.01	-0.05	1.16	-0.01	-0.04	1.18
Education	-0.76*	-0.21	1.12	-0.55	0.02	1.21
Employment	-0.16	-0.04	1.35	-0.16	0.04	1.39
Coffee consumption				-0.30	-0.08	1.21
BMI				-0.01	-0.02	1.66
Physical activity				-0.11	-0.03	1.62
Number of complications				0.15	0.08	1.23
DM duration				0.03	0.14	1.08
Oral/Oral and insulin				-0.08	-0.02	
Insulin/Oral and insulin				-0.01	-0.00	
Diet/Oral and insulin				-1.93	-0.12	
PSS				0.12**	0.31	
R^2	.064*			.236*		
Adjusted R^2	.038			.162		
ΔR^2	.064			.172		

Note: * $p < .05$, ** $p < .001$

In the second model, demographic data were controlled. The variables such as coffee consumption habits, BMI, physical activity, disease characteristics, and Perceived Stress Scale scores were included in the analysis. There is a strong correlation between the Perceived Stress Scale score and the respondent's sleep quality ($\beta = 0.31$; $p = p < .001$), indicating that the higher the respondent's stress level, the lower the respondent's sleep quality. There is an increase in R2 (R2 = .236). From the second model, it can be interpreted that after all variables were included in the multiple hierarchical linear regression analysis, the Perceived Stress Scale score contributed 23.6% to the sleep quality score.

DISCUSSIONS

The results of this study show that more than half of all respondents are women. Women show more dramatic hormonal and bodily changes due to reproductive factors throughout their lives. Additionally, body composition and fat metabolism contribute to the emergence of DM in women (Kautzky-Willer, Harreiter, & Pacini, 2016). The average BMI of all respondents was 26.25 kg/m2, which indicates that the respondents were overweight. The incidence of diabetes is often found in individuals who have an

excessive BMI compared to individuals with a normal BMI (Gupta & Bansal, 2020). In accordance with the results of this study, the average age of respondents was 59 years. The aging process of the human body causes disturbances in energy homeostasis and abnormalities in carbohydrate metabolism. The predominant cause of hyperglycemia is insulin secretion deficiency that develops along with the increase in age and increasing insulin resistance (Mordarska & Godziejewska-Zawada, 2017). The incidence of type 2 diabetes mellitus is higher in respondents with low education levels. Respondents in the lowest education tend to have a higher BMI. BMI remains an important factor in developing T2DM in the elderly (Steele et al., 2017). The incidence of impaired glucose metabolism increases in men and women who are unemployed. Among individuals unemployed for more than one year, around 13.1% of diabetes risk was associated with unemployment in men and 10.3% in women (Rautio, Varanka-Ruuska, Vaaramo, & Ala-Ursula, 2017). In line with the results of this study, it was found that the number of respondents who did not work was greater than those who worked (n = 113, 75.3%).

Respondents in this study had at least 1 complication from diabetes mellitus (n = 66, 44%). Neuropathy was the most common complication found in this study population. The duration of someone suffering from diabetes is related to the emergence of neuropathy complications (Feldman et al., 2019). In this study, the average duration of suffering from diabetes was 10 years. Therefore, it is possible that the emergence of neuropathy in respondents is related to the duration of the disease.

Respondents' perceived stress was in the moderate category (mean = 16.13, SD = 4.59), with 107 respondents (71.3%) in the moderate stress category. Psychological stress is known to be one of the risk factors for chronic diseases such as DM. Pathophysiological mechanisms of DM related to stress include direct neuroendocrine effects. The cortisol and adrenaline as stress hormones oppose insulin regulation (Kelly & Ismail, 2015). The average perceived stress in this study was higher than in previous studies conducted in China, namely a mean of 14.1 (SD = 6.7) (F. Fang Zhao, Suhonen, Katajisto, & Leino-Kilp, 2018). Research by Zhao, Suhonen, Katajisto, & Leino-Kilpi (2018) also stated that respondents who had diabetes for more than 5 years tend to experience anxiety, and women also tend to experience stress. This study's mean perceived stress score is higher than previous research, possibly due to the pandemic conditions. A previous study reported more than half of the research respondents were worried that they would be excessively affected by diabetes if infected with COVID-19. Apart from that, respondents were worried because patients with diabetes mellitus were included in a group at risk of being infected with COVID-19 (Joensen et al., 2020).

The average PSQI global score in the study showed that respondents' sleep quality was in the poor category (mean = 5.33; SD = 1.79). The mean PSQI global score is lower than the previous research, in which the mean PSQI global score was 10.2 (SD = 3.10) (Barakat, Abujbara, & Banimustafa, 2019). Poor sleep quality is also associated with poor glycemic control. A study conducted in Qatar also reported the high prevalence of poor sleep quality among people with T2DM during the COVID-19 pandemic (Abdu et al., 2023). Physical distancing and minimum physical activity could impact fluctuating blood sugar levels, leading to sleep disturbance.

The results of this study indicate that respondents experienced moderate stress. In the second model, it was found that only the PSS global score was a predictor of sleep quality (Table 4). This shows that the stress experienced by respondents has an impact on the quality of their sleep. Similar research also obtained the same results, namely, a significant relationship exists between perceived stress and sleep quality in diabetes mellitus patients (Haveleia & Gayatri, 2019). The Hypothalamic Pituitary Adrenal axis (HPA) axis, central catecholamine system, and sympathetic system play important roles in regulating the sleep-wake cycle. In addition, dysregulation of nerve and neuroendocrine mediators as a result of the stress response can cause sleep disorders. Sleep disturbances primarily respond to stress and poor mental and physical health (Prather, Bogdan, & Hariri, 2013). Research in the general population shows that higher stress predicts lower sleep quality during the COVID-19 pandemic. The higher the perceived stress the respondent feels correlates with lower sleep quality (X. Zhao, Lan, Li, & Yang, 2020). From these results, it can be seen that it is important to monitor stress levels and improve sleep quality in patients with type 2 diabetes mellitus. Therefore, providing appropriate interventions related to these two factors is very necessary. This study has some limitations. First, the sleep quality was

assessed using PSQI, which needs to be confirmed with polysomnography as a standardized sleep quality test. Second, the results could not be generalized since the data were collected from one private hospital.

CONCLUSION

Only perceived stress contributed as a predictor of sleep quality in this study population. The higher the respondent's stress level, the lower the respondent's sleep quality. Nurses should screen for psychological problems during stressful conditions like the Covid-19 pandemic. Nurses can develop nursing interventions to improve the sleep quality of type 2 diabetes mellitus patients, especially during the Covid-19 pandemic

REFERENCES

Abdu, Y., Naja, S., Izham, M., Ibrahim, M., Abdou, M., Ahmed, R., … Bougmiza, I. (2023). Sleep Quality Among People with Type 2 Diabetes Mellitus During COVID-19 Pandemic : Evidence from Qatar's National Diabetes Center. *Diabetes, Metabolic Syndrome and Obesity*, (May), 2803–2812. https://doi.org/10.2147/DMSO.S421878

Arora, T., Chen, M. Z., Omar, O. M., Cooper, A. R., Andrews, R. C., & Taheri, S. (2016). *An investigation of the associations among sleep duration and quality, body mass index, and insulin resistance in newly diagnosed type 2 diabetes mellitus patients*. 3–11. https://doi.org/10.1177/2042018815616549

Barakat, S., Abujbara, M., & Banimustafa, R. (2019). Sleep Quality in Patients With Type 2 Diabetes Mellitus. *Journal of Clinical Medicine Research*, *11*(4), 261–266. https://doi.org/10.14740/jocmr2947w

Buysse, D. J., Reynolds, C. F., Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh Sleep Quality Index : A New Instrument Psychiatric Practice and Research. *Psychiatry Research*, *28*. https://doi.org/https://doi.org/10.1016/0165-1781(89)90047-4. https://doi.org/10.1016/0165-1781(89)90047-4

Cohen, S. (1988). Perceived stress in a probability sample of the United States. In S. Spacapan, & S. Oskamp (Eds.). *The Social Psychology of Health*, 31–67.

Feldman, E. L., Callaghan, B. C., Pop-busui, R., Zochodne, D. W., Wright, D. E., Bennett, D. L., … Viswanathan, V. (2019). Diabetic neuropathy. *Nature Reviews Disease Primers*, *5*(41). https://doi.org/10.1038/s41572-019-0092-1

Fontela, P. C., & Berlezi, E. M. (2015). Sleep Respiratory Disorders and Clinical Pro fi le in Patients with Type 2 Diabetes Mellitus. *International Archives of Otorhinolaryngology.*, *19*. https://doi.org/10.1055/s-0034-1395998

Gupta, S., & Bansal, S. (2020). Does a rise in BMI cause an increased risk of diabetes ?: Evidence from India. *Plos One*, *15*(4), 1–20. https://doi.org/10.1371/journal.pone.0229716

Haveleia, A., & Gayatri, D. (2019). Sleep quality and the affecting factors in patients with diabetic ulcer ଌ. *Enfermería Clínica*, *29*, 70–75. https://doi.org/10.1016/j.enfcli.2019.04.011. IDF. (2021). *IDF Diabetes Atlas*. Retrieved from https://diabetesatlas.org/atlas/tenth-edition/

Joensen, L. E., Madsen, K. P., Rod, N. H., Willaing, I., Holm, L., Nielsen, K. A., … Petersen, A. A. (2020). Research : Educational and Psychological Aspects Diabetes and COVID-19 : psychosocial consequences of the COVID-19 pandemic in people with diabetes in Denmark — what characterizes people with high levels of COVID-19-related worries ? *Diabetic Medicine*, 1146–1154. https://doi.org/10.1111/dme.14319

Kang, H. (2021). Sample size determination and power analysis using the G * Power software. *Journal of Educational Evaluation for Health Professions*, *18*, 1–12. https://doi.org/10.3352/jeehp.2021.18.17

Kautzky-Willer, A., Harreiter, J., & Pacini, G. (2016). Sex and Gender Differences in Risk, Pathophysiology and Complications of Type 2 Diabetes Mellitus. *Endocrine Review*, *37*(3), 278–316. https://doi.org/10.1210/er.2015-1137

Kelly, S. J., & Ismail, M. (2015). Stress and Type 2 Diabetes : A Review of How Stress Contributes to the Development of Type 2 Diabetes. *The Annual Review OfPublic Health*, *36*, 441–462.

https://doi.org/10.1146/annurev-publhealth-031914-122921

Lou, P., Qin, Y., Zhang, P., Chen, P., Zhang, L., Chang, G., … Zhang, N. (2014). Association of sleep quality and quality of life in type 2 diabetes mellitus: A cross-sectional study in China. *Diabetes Research and Clinical Practice*. https://doi.org/10.1016/j.diabres.2014.09.060

Merrill, R. M. (2022). Mental Health Conditions According to Stress and Sleep Disorders. *International Journal of Environmental Research and Public Health*, *19*. https://doi.org/10.3390/ijerph19137957

Mohammed, S., Sokwalla, R., Joshi, M. D., Amayo, E. O., Acharya, K., Mecha, J. O., & Mutai, K. K. (2017). *Quality of sleep and risk for obstructive sleep apnoea in ambulant individuals with type 2 diabetes mellitus at a tertiary referral hospital in Kenya : a cross-sectional , comparative study*. 1–8.

Mordarska, K., & Godziejewska-zawada, M. (2017). Diabetes in the elderly. *Przegląd Menopauzalny*, *16*(2), 38–43. https://doi.org/10.5114/pm.2017.68589

Osonoi, Y., Mita, T., Osonoi, T., Saito, M., Tamasawa, A., Nakayama, S., … Watada, H. (2015). Poor sleep quality is associated with increased arterial stiffness in Japanese patients with type 2 diabetes mellitus. *BMC Endocrine Disorders*, 1–7. https://doi.org/10.1186/s12902-015-0026-1

Prather, A. A., Bogdan, R., & Hariri, A. R. (2013). NIH Public Access. *Psychosom Med*, *75*(4), 350–358. https://doi.org/10.1097/PSY.0b013e31828ef15b

Rautio, N., Varanka-ruuska, T., Vaaramo, E., & Ala-mursula, L. (2017). Accumulated exposure to unemployment is related to impaired glucose metabolism in middle-aged men : A follow-up of the Northern Finland Birth Cohort 1966. *Primary Care Diabetes*, *11*(4), 365–372. https://doi.org/10.1016/j.pcd.2017.03.010

Schäfer, T., & Schwarz, M. A. (2019). The Meaningfulness of Effect Sizes in Psychological Research : Differences Between Sub-Disciplines and the Impact of Potential Biases. *The Journal Frontiers in Psychologyournal Frontiers in Psychology*, *10*(April), 1–13. https://doi.org/10.3389/fpsyg.2019.00813

Shibabaw, Y. Y., Dejenie, T. A., & Tesfa, K. H. (2023). Glycemic control and its association with sleep quality and duration among type 2 diabetic patients. *Metabolism Open*, *18*(March), 100246. https://doi.org/10.1016/j.metop.2023.100246'

Steele, C. J., Schöttker, B., Marshall, A. H., Kouvonen, A., Doherty, M. G. O., Mons, U., … Kee, F. (2017). *Education achievement and type 2 diabetes — what mediates the relationship in older adults ? Data from the ESTHER study : a population-based cohort study*. 4–6. https://doi.org/10.1136/bmjopen-2016-013569

Westman, E. C. (2021). *Type 2 Diabetes Mellitus : A Pathophysiologic Perspective*. *8*(August), 1–5. https://doi.org/10.3389/fnut.2021.707371

Yunzhao, T., Lingling, M., Daiqing, L., Min, Y., Yanjuan, Z., Chenguang, L., … Changlin, N. (2014). Interaction of sleep quality and sleep duration on glycemic control in patients with type 2 diabetes mellitus. *Chinese Medical Journal*, *127*(20). Retrieved from https://pubmed.ncbi.nlm.nih.gov/25316226/https://doi.org/10.3760/cma.j.issn.0366-6999.20141512

Zhao, F. fang, Suhonen, R., Katajisto, J., & Leino-Kilp, H. (2018). The association of diabetes-related self-care activities with perceived stress , anxiety , and fatigue : a cross-sectional study. *Patient Prefer Adherence*, *12*, 1677–1686. https://doi.org/10.2147/PPA.S169826

Zhao, X., Lan, M., Li, H., & Yang, J. (2020). Perceived stress and sleep quality among the non-diseased general public in China during the 2019 coronavirus disease : a moderated mediation model. *Sleep Medicine*, (January). https://doi.org/10.1016/j.sleep.2020.05.021